SERVING THE FERTILIZER INDUSTRY 50 YEARS

Commercial Fertilizer

and PLANT FOOD INDUSTRY

March
1960

Are You Taking Full Advantage of Nitrogen Division Service?

See Page 19

Advertisement of NITROGEN DIVISION, ALLIED CHEMICAL

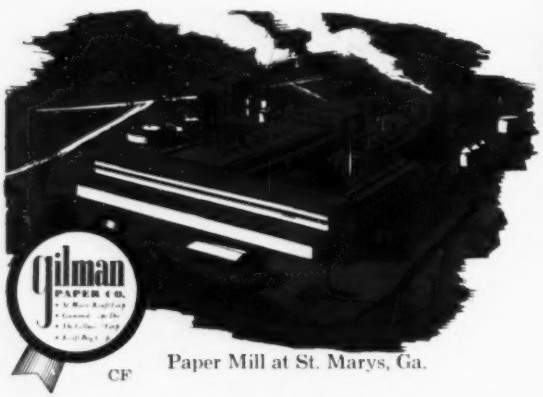
"It wasn't there last year!"

This is the new 300,000 sq. ft. addition to Kraft Bag Corporation's converting plant at St. Marys, Georgia, scheduled to go "on stream" in February.

Here, in one giant integrated operation, logs from our own forest lands are turned into pulp, then into paper, and finally into heavy duty multiwall shipping sacks, using the most modern machinery and equipment the industry affords.

This expansion of our facilities is one more step in our constant efforts to provide our customers with the best in quality and service.

We invite your inquiries.



CF Paper Mill at St. Marys, Ga.

KRAFT BAG CORPORATION

Gilman Paper Company Subsidiary

630 Fifth Avenue, New York 20, N. Y.

Daily News Building, Chicago 6, Ill.

LONG-LASTING, UNIFORM FEEDING PROVIDED BY

SMIROW

TANKAGE

100% natural organic nitrogen supplements chemical plant food

Used in mixed fertilizers or applied direct, SMIROW tankage provides controlled release of plant nutrients for long-lasting, uniform feeding. SMIROW is not a synthetic — but 100% natural organic. SMIROW has been the natural organic favorite of fertilizer manufacturers and farmers for over 38 years.

- ***UNIFORM IN COLOR AND TEXTURE***
- ***EASILY IDENTIFIED IN MIXED FERTILIZER***
- ***NO DUST PROBLEM***
- ***NO FIRE HAZARD***

Let us figure the cost of SMIROW delivered to your plant. Write for free samples.

SMIROW

A PRODUCT OF THE

SMITH-DOUGLASS

COMPANY, INCORPORATED • NORFOLK 1, VIRGINIA

Better be safe

than sorry!

GRANULATION NOW

Especially in the South, next season will see an insistent demand for granular fertilizers . . . and **now** is the time to start equipping for granulation. With an early start we can have you ready by the time the need gets urgent.

You probably know the Weatherly standing in this field. **Weatherly Controlled Granulation** plants all over the mid-West and South have proven the soundness of Weatherly design over a 6-year period.

You save on first cost, on materials, on manpower, on maintenance. And you turn out a product that makes you more friends and more money—because of Weatherly engineering.

When we turn the plant over to you it will produce uniform product with granules through 6 and on 16 mesh screen. We guarantee product size and production rate.

20 to 60 tons per hour . . . as your market indicates.

OUR PLANTS PURR LIKE KITTENS

The D. M. WEATHERLY COMPANY

Industrial Engineers and Builders

80 Eleventh St., N.E., Atlanta, Georgia Phone: TRinity 5-7986

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and PLANT FOOD INDUSTRY

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Commenting Freely

by BRUCE MORAN

We have a feeling that the newly created Sulphur Institute will get a warm welcome in our industry. It can be a factor in avoiding confusion, such as plagues most of our suppliers at one time or another. It can focus research for the good of the farmer and ourselves. It can make all concerned more aware of the broad aspects of sulphur as a servant of agriculture.

The selection of Dr. Russell Coleman as president of the new Institute is a happy one. He demonstrated his sincerity and his skill long before he went to NFA, and in that organization and in NPFI he showed the breadth of his vision, and his real capacity for accomplishment.

So we join those who welcome Dr. Coleman to his new post, extending our congratulations to the industry he now represents, and to him.

Just Say DUVAL That's All

and get both automatically

Continuing research and development assure you of consistently fine quality. Continuing recognition of the industry's need for dependable deliveries assures you of consistently fine service—same day shipment.

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MURIATE OF POTASH

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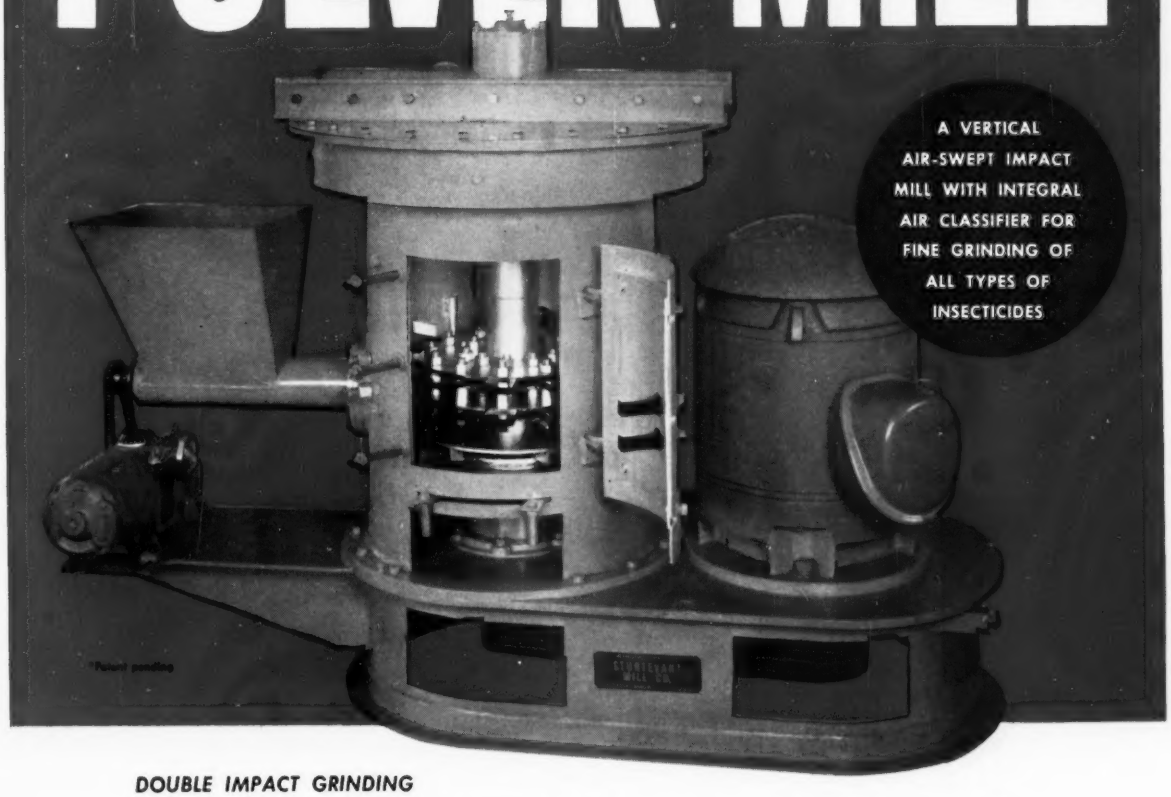
ATTENTION: Insecticide Formulators

the New STURTEVANT PULVER-MILL



DOUBLE IMPACT GRINDING

Revolving impactors pass between fixed wall impactors to substantially increase grinding efficiency.

DEFLECTOR WALL CONSTRUCTION

Exclusive Deflector Wall design "bounces" partially ground material back into the grinding zone — speeds grinding process.

ADJUSTABLE AIR CLASSIFICATION

Special intake vane design "whirls" vertical air flow. Adjustable selector bar system provides precise end-product selection.

Write for full information. Request Bulletin 094.

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SEPARATORS

STURTEVANT MILL COMPANY
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GRANULATORS
CONVEYORS
ELEVATORS

PRODUCTS AND SERVICES FROM IMC

- **Phosphate Rock**
- **Triple Superphosphate (Coarse, Granular, Run-of-pile)**
- **Phosphoric Acid**
- **Muriate of Potash (Coarse, Standard, Granular)**
- **Sulphate of Potash**
- **Sul-Po-Mag®**

Manufacturing and Technical Service
Transportation Service
Customer Service
Management Services
Marketing Services

INTERNATIONAL'S FULL ORBIT SERVICE

IMC's Man with a Sales Mission applies product and assistance to all phases of his customer's fertilizer business.

Because of today's critical need for improved fertilizers and methods, IMC concentrates on rigidly controlled product quality and market penetrating assistance . . . it makes your IMC representative a . . .

MAN WITH A SALES MISSION

His mission: superior fertilizer ingredients that help you move more finished goods to the farm . . . your total success with his products and services.

He handles a full line of fertilizer ingredients — each carefully controlled through every step of production — recovery, blending, drying, grinding, and loading. These are products of superior specifications to meet today's growing preference for multiple sources of nitrogen, potash and phosphorus within a single formula.

These are the products of his full-line service:

Phosphate Rock — Run-of-mine or ground to your own exacting specifications. IMC conducts 57 sample tests an hour for grade uniformity. Result: ideal acidulation. Vast resources give you the grade and tonnage you want when you want it.

Triple Superphosphate — ROP, coarse or granular. Guaranteed 46% APA. Extra-long reaction time and natural curing promote physical and chemical characteristics that make handling and storing easy. IMC Triple Superphosphate is of uniformly high analysis, gives fewer reversion problems.

Phosphoric Acid — cuts corners on formulation costs, keeps high grades on the low side of cost control. Wet process, 53-55% P_2O_5. Delivered in rubber-lined tank cars — rush season, any season.

Muriate of Potash — coarse, standard, granular. Minimum guarantee 60% K_2O; typical analysis 61%. For mixed fertilizers, direct application or pelletized mixed goods. IMC has the resources to help you formulate with specific grades, meet production schedules every time.

Sulphate of Potash — less than 2½% chlorine, acid free. Minimum guarantee 50% K_2O; typical analysis 51.7% K_2O.

Sul-Po-Mag* — Sulphate of potash-magnesia, water soluble, fast acting, low chlorine content. Minimum guarantee 18% MgO, 21% K_2O; typical analysis 18.8% MgO, 22.6% K_2O. Now recognized as a major fertilizer ingredient, also used for direct application.

Above all, he makes consistency of product quality within his full line his first obligation. His mission is your success. Just give him a call.

Products for Growth* IMC

*Trademark

AGRICULTURAL CHEMICALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Administrative Center: Skokie, Illinois

18-60

A full line of quality-controlled products meets the needs of individual formulas and processes — handling, mixing, storing.

IMC's Man with a Sales Mission isn't finished until his customer's product is on the farm — in greater volume.

Boss of a "*Penny-Pinching Brain*"

He heads up the Phillips *66* Electronic Computer Service that is proving so effective in working out "penny-pinching" fertilizer formulations for Phillips *66* mixer customers. Although the savings may be only pennies per ton, they can run into thousands of dollars a year.

For example, using the electronic "brain" resulted in a sizable profit increase for one fertilizer manufacturer. He supplied Phillips with an analysis of his materials, the grades of fertilizer and amounts of each he wished to make. The production schedule and formulations figured out by the Electronic Computer saved him from 30 cents to $1.50 per ton on material costs. The net saving during the year came to almost $15,000.

Computing formulations is not the only way Phillips can serve you. Phillips advertising and sales aids promote farmer-dealer cooperation and increased use of mixed fertilizers. Phillips will also help in sales and industry meetings for your salesmen and dealers . . . provide skilled technical assistance . . . and, of course, give you dependable delivery on high quality Nitrogen solutions, Anhydrous Ammonia, Ammonium Nitrate, Ammonium Sulfate, and Triple Superphosphate. If you have a formulation problem, call or write the nearest office listed below.

"Good name to grow by"

PHILLIPS 66

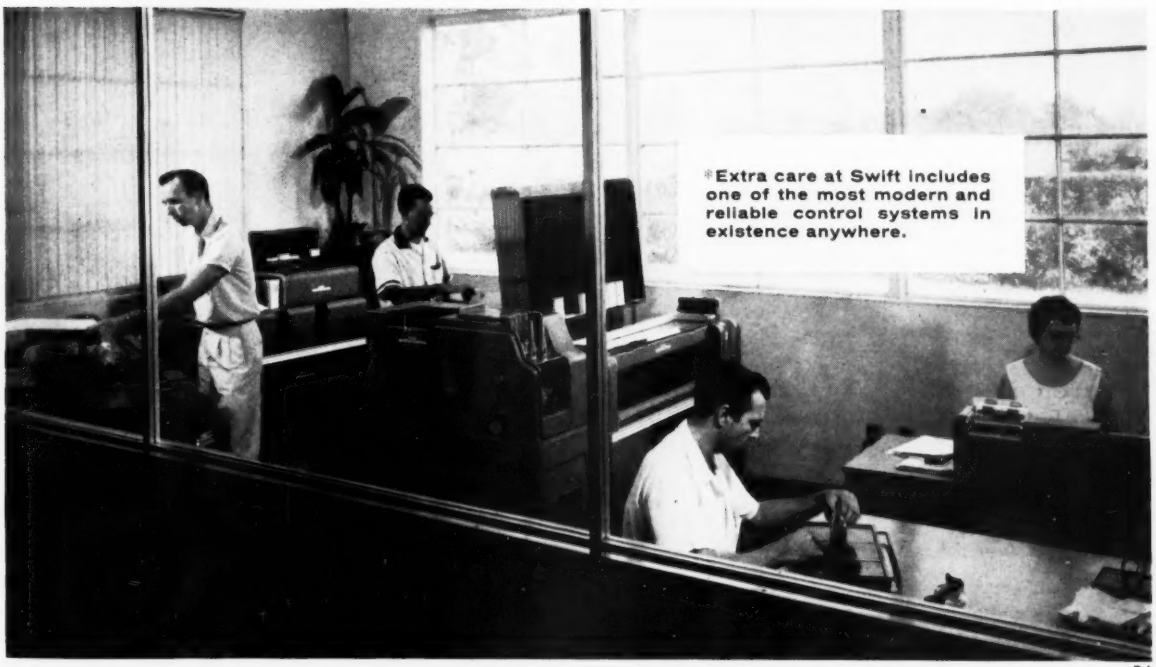
PHILLIPS PETROLEUM COMPANY, *Bartlesville, Oklahoma*

SALES OFFICES:

AMARILLO, TEX.—*First Nat'l Bank Bldg.*
ATLANTA, GA.—*1428 West Peachtree Street, Station "C" P. O. Box 7313*
BARTLESVILLE, OKLA.—*Adams Building*
CHICAGO, ILL.—*7 South Dearborn St.*
COLUMBUS, OHIO—*395 E. Broad St.*
DENVER, COLO.—*1375 Kearney St.*
DES MOINES, IOWA—*6th Floor, Hubbell Bldg.*
HOUSTON, TEX.—*6910 Fannin Street*
INDIANAPOLIS, IND.—*3839 Meadows Drive*
KANSAS CITY, MO.—*201 E. Armour Blvd.*
MAPLEWOOD, N. J.—*2075 Millburn Ave.*
MINNEAPOLIS, MINN.—*215 South 11th St.*
OMAHA, NEB.—*3212 Dodge St.*
PASADENA, CALIF.—*317 N. Lake Ave.*
RALEIGH, N. C.—*401 Oberlin Road*
SALT LAKE CITY, UTAH—*68 South Main*
SPOKANE, WASH.—*521 E. Sprague*
ST. LOUIS, MO.—*4251 Lindell Blvd.*
TAMPA, FLA.—*3737 Neptune St.*
TULSA, OKLA.—*1708 Utica Square*
WICHITA, KAN.—*501 KFH Building*

Intensive customer service . . .
part of the extra care* behind

SWIFT'S PHOSPHATES



Swift's *extra care* is just as real as is the staff that provides it. Take Customer Service, for example. This is the department to call when you want information on cars shipped, car numbers, dates and routing. With the support of a modern, precise control system you get accurate up-to-the-minute information promptly. And this is just one part of the whole Swift organization dedicated to providing better phosphate service.

Swift's extra care can help you even better satisfy your customers . . . your plant operations . . . and your profits. It's worth checking! Have a Swift Phosphate Center Representative outline the advantages Swift offers you in phosphates—Triple, rock or ground rock.

THE SERVICE CENTER FOR ALL YOUR PHOSPHATE NEEDS

SWIFT & COMPANY
PHOSPHATE CENTER
Bartow, Florida

Swift
105TH YEAR

To Serve Your Industry Better WITH PHOSPHATE ROCK,
GROUND PHOSPHATE ROCK AND MINUTE MAN TRIPLE SUPERPHOSPHATE

JUST AROUND THE CORNER

By Vernon Mount

Now that international complications have been avoided by delaying the execution of that man on the West Coast so Uruguay won't be upset by it; and now that the Finch trail is over; and now that the feud between the services, over outer space, has subsided a little; and now that there is hope snow will stop piling up on busy thoroughfares, March getting ready to go out like a lamb . . .

....Maybe we can pay better attention to the Big Battle in the halls of Congress.

In the current issue of Better Homes & Gardens, Burton Hillis has a comment that the toughest evening's work he ever had was helping Burton Jr. write a theme on the difference between a Republican and a Democrat. This just about sums up the situation in Washington at the moment.

But both sides are striving to create differences. The Democrats working on "issues" that will help "turn the rascals out". The Republicans on ways and means of proving that what has been done was well done in the past seven years.

It's not so funny when you realize that vital matters are becoming footballs. Important things are being handled, not for the good of the People – but for the confusion of the People.

It must vastly amuse the dictators!

Yours faithfully,

Vernon Mount

ASHCRAFT-WILKINSON CO.

Fertilizer Materials — *Oil Seed Meals*

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Cable Address
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Offices: NORFOLK, VA., CHARLESTON, S. C., TAMPA, FLA.
JACKSON, MISS., COLUMBUS, OHIO, MONTGOMERY, ALA.
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ESCAMBIA CHEMICAL CORPORATION

AMMONIATES — SULPHUR — POTASH
INDUSTRIAL AND AGRICULTURAL CHEMICALS

SWEET MUSIC TO BAG BUYERS

Chase customers call the tune—and Chase follows through. The key to our whole business is giving *you* the bags you want, when *you* want them, made right, and priced right. But it doesn't end with filling your order . . . Chase continues working in complete harmony with you . . . making available the newest and most efficient materials, helping cut costs, eliminating waste, by individualized attention to your requirements. Some may call it "extra" service . . . at Chase, we know it's the *ONLY* right way to serve you.

Our 112th Year

CHASE

BAG COMPANY

General Sales Offices: 155 East 44th St., New York 17, N.Y.

BAG PLANTS AND SALES OFFICES COAST TO COAST
—A NATIONWIDE STAFF OF BAG SPECIALISTS

NOW — A CONVEYOR IDLER PROVIDING TRUE CATENARY SUSPENSION FOR THE BELT

the S-A FLEXIROLL®

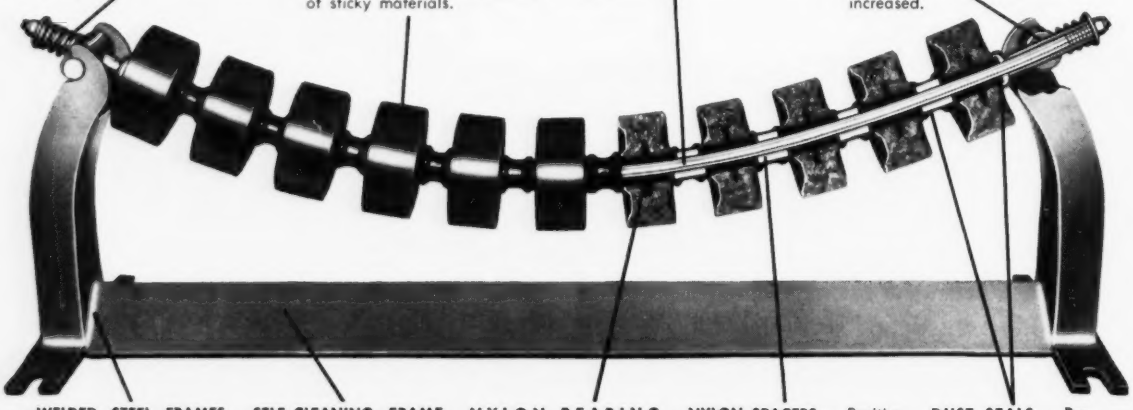
CATENARY CARRIERS FOR BELT CONVEYORS

EASY REPLACEMENT—Shaft, and entire idler assembly simply lifts out of ears in brackets, merely by depressing trunnion spring.

FLEXITEX MOULDED ROLLER — High resistance to abrasion, combustion and chemical corrosion. Cushions impact of material on belt, prevents build-up of sticky materials.

SPRING STEEL SHAFT 85/95 TONS TENSILE — Provides natural troughing with belt under all load conditions. Prolongs belt life.

STEEL TRUNNION & TRUNNION SPRING — Trunnion is offset to provide ease of adjustment for belt training — spring is shock absorbing to flex as load is increased.



WELDED STEEL FRAMES — All steel, deeply-ribbed end stands accurately jig-welded to the stiff angle cross-member.

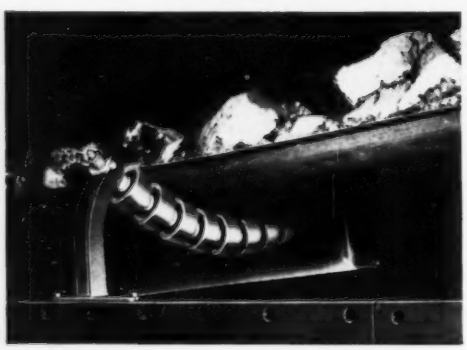
SELF-CLEANING FRAME — Inverted angle cross-member and self-cleaning end-brackets prevent material from collecting and fouling rollers.

NYLON BEARING GRAPHITE IMPREGNATED — Ensures long life without maintenance. No lubrication required.

NYLON SPACERS — Positive connection between rollers is achieved by mating jaws of nylon spacer and bearing of roller.

DUST SEALS — Protects bearings from ingress of foreign matter.

AVAILABLE FOR 18", 20", 24", 30" and 36" BELT WIDTHS



Closeup of a 30" S-A FLEXIROLL Catenary Idler in operation on belt conveyor handling coal. There is no fire risk with the FLEXIROLL and material breakage is reduced to a minimum.

- Resists corrosion, abrasion, grease, flame, oil, clogging and freezing.
- Increases belt training and greatly reduces belt wear.
- Both idler and stand self cleaning — eliminate material build-up.
- No metal to metal contact — flexing of idler prevents dust build-up, eliminating fire risk.
- Flexing action reduces material breakage, prevents spillage.
- One-third the weight of all-metal idlers — saves space, weight in supporting structures.
- Idlers can be changed without stopping the belt.
- Spring steel spindle provides greater strength than steel cable used in many Catenary-Type idlers.
- All-steel flanged and jig welded frames.
- Catenary suspension of the FLEXIROLL carrier supports the belt in a natural arc.

WRITE FOR BULLETIN 260

S-A
ENGINEERED BULK HANDLING SYSTEMS
MATERIALS HANDLING PRODUCTS
SPEEDWALK PASSENGER CONVEYORS
SEALMASTER BALL BEARING UNITS
SPHERCO BEARINGS & ROD ENDS

STANDARD PRODUCTS DIVISION
STEPHENS-ADAMSON MFG. CO.
GENERAL OFFICE & MAIN PLANT, 421 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

Old Dobbin and the walking plow were indispensable in the early days of cultivating our land.

Engine power has replaced "horse power," making possible bigger farms, better tillage, more economical farming.

FERTILIZER PLANTS HAVE MODERNIZED, TOO

Just as Old Dobbin and the walking plow have given way to modern tractor plowing, so, too, has fertilizer manufacturing been improved. Today, fertilizer manufacturing employs precise, scientific techniques incorporating modern equipment and chemical engineering know-how.

If you have agronomic or fertilizer manufacturing problems, or are looking for new information on improved techniques for more economical production, just call on Texaco for help and suggestions. Our Technical Service people in these fields have a wealth of experience in agronomy and fertilizer manufacturing, both in research and practice.

Texaco Inc., *Petrochemical Sales Division,* 332 South Michigan Avenue, Chicago 4, Ill., or 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO

PETROCHEMICALS

AQUA AMMONIA, ANHYDROUS AMMONIA, NITROGEN SOLUTIONS, DIISOBUTYLENE, ODORLESS MINERAL SPIRITS, NAPHTHENIC ACID, PROPYLENE TETRAMER AND RUST INHIBITORS

TENNESSEE CORPORATION

COPPER SULFATE

Tennessee Corporation mines Copper and converts it to Copper Sulfate at Copperhill, Tennessee. It is offered in powdered form as well as Large, Medium, Industrial, Granular and Snow Crystals.

Users who require very high uniformity and purity, but at a competitive price, specify TENNESSEE COPPER SULFATE.

Copper Sulfate and other copper chemicals

TENNESSEE CORPORATION

New 1100 TPD Concentrated Complete Fertilizer Granulation Plant

Designed by DORR-OLIVER for Imperial Chemical Industries Limited

The more than 40-year-old experience of the Dorr-Oliver organization in designing or equipping nearly 50 fertilizer projects in 17 countries has been utilized in another spectacular development—the largest C.C.F. granulation plant in the British Commonwealth and one of the largest in the world.

The plant is the latest addition to the immense 1100-acre chemical complex operated by Imperial Chemical Industries Limited at Billingham, England. Sulphate of ammonia, monoammonium phosphate and muriate of potash are combined by the Dorrco Granular Fertilizer Process to form a concentrated complete 12-12-18 fertilizer. Two processing units produce a total of 1100 tons per day. Advanced design and extensive use of instrumentation results in high productivity with a relatively small labor force.

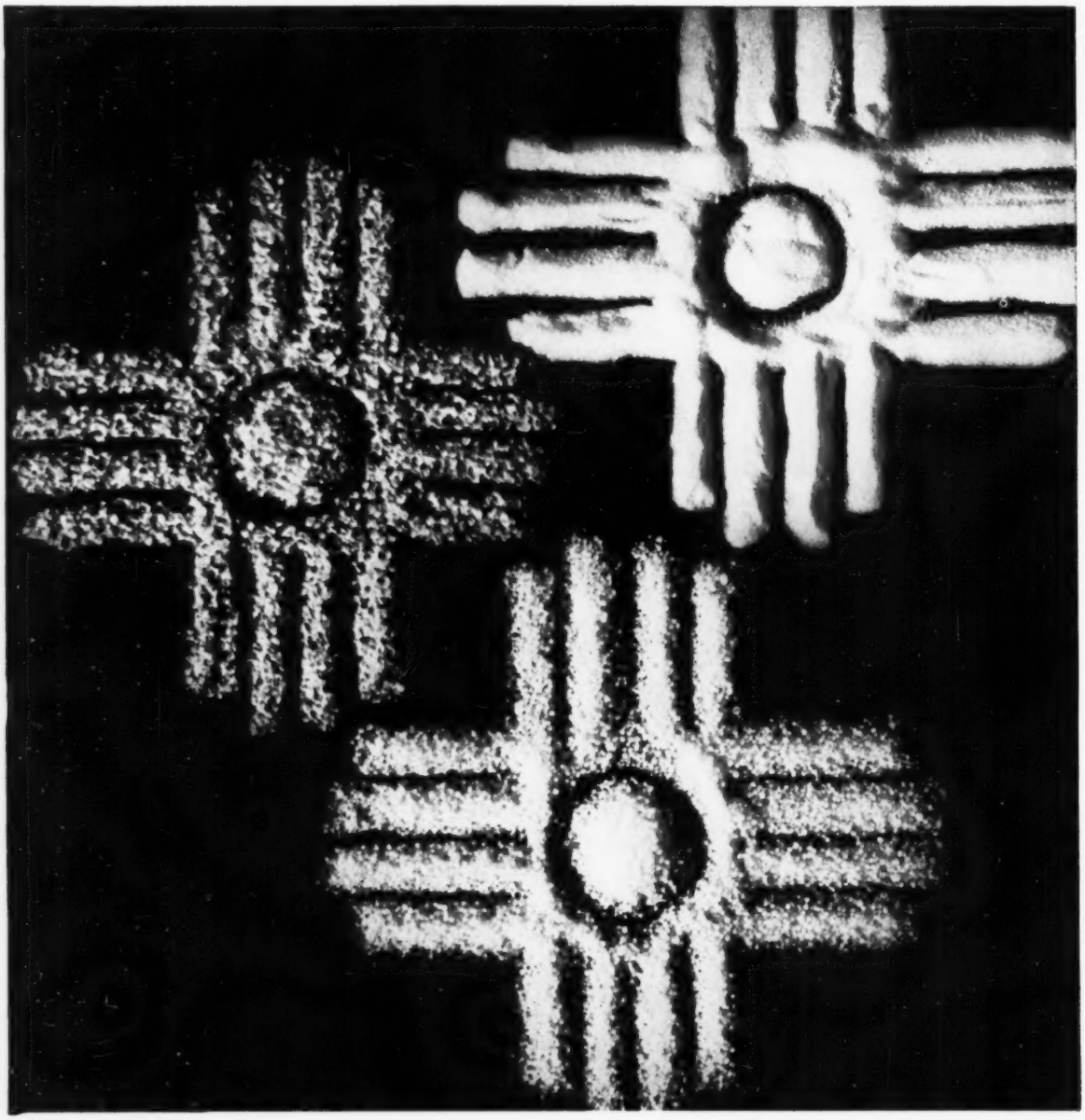
If you are interested in the field of fertilizer production, call for a preliminary discussion, or write for information to Dorr-Oliver Incorporated, Stamford, Connecticut.

The services of Dorr-Oliver cover all phases of fertilizer plant design, from economic analysis to supervision of initial operation.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

Dorrco—T.M. Reg. U.S. Pat. Off.



To help you make better fertilizers... three grades of specially-sized potash

Muriate of potash ideally sized to meet your fertilizer manufacturing requirements. For mixed fertilizers, you get most potash per ton from our two white grades—Higrade muriate, and Higrade Granular muriate—each contains 62/63% K_2O. For fertilizers requiring a larger particle size, choose our Granular muriate containing 60% K_2O. All three grades are specially refined to resist caking and remain free-flowing. The particle sizes are uniform.

Complete technical data, samples, and accurate shipping information will be furnished promptly by our expertly staffed Technical Service Department on request.

UNITED STATES BORAX & CHEMICAL CORPORATION
50 Rockefeller Plaza, New York 20, N.Y.

Southern Sales Office: Rhodes-Haverty Building, Atlanta, Georgia

Basic Producers of Potash and Borates for the Fertilizer Industry

UNITED STATES POTASH
A PRODUCT OF NEW MEXICO U.S.A.

REG. U.S. PAT. OFF.

Arcadian® News

Volume 5 | For Manufacturers of Mixed Fertilizers | Number 3

Are You Taking Full Advantage of Nitrogen Division Service?

During your rush season and in any season, Nitrogen Division, Allied Chemical, is better equipped than any other nitrogen producer *to serve you.* Here are three important reasons why—

1 Technical Assistance

To provide its customers with competent, well-qualified technical assistance, Nitrogen Division maintains the largest, best-trained, most-experienced staff of fertilizer technologists in the industry. This staff includes hundreds of fertilizer technicians, scientists and engineers working with millions of dollars worth of laboratory and pilot plant equipment.

These men are ready, willing and able to help you find the practical answer to your formulation, ammoniation and manufacturing problems. The accumulated skill of many years of experience augments your own efforts. And this service is available to customers without charge.

Nitrogen Division technical men work on your problem in your plant or in their laboratories using the most modern facilities. They are skilled in ferreting out trouble spots and in helping you to quickly correct operating techniques.

Remember, Nitrogen Division technologists originated and developed nitrogen solutions and the practice of ammoniating superphosphate. They have the *know-how* that counts when you need help fast!

2 Production Capacity

Long-time leading producer of fertilizer nitrogen, Nitrogen Division owns and operates three huge plants—at Hopewell, Virginia; South Point, Ohio; and Omaha, Nebraska—by far the biggest nitrogen production capacity in the country. And, Nitrogen Division offers the most complete line of nitrogen products available to the fertilizer manufacturer.

Look over the list of ARCADIAN® Nitrogen Solutions and other ARCADIAN Nitrogen Products on page 4 of this issue of ARCADIAN NEWS. No other nitrogen producer is so well prepared to supply your complete nitrogen needs. You can get the exact nitrogen products you want from Nitrogen Division—and *all* your nitrogen from one source.

3 Delivery Facilities

Getting your order to you on time for you to meet production schedules is standard procedure for Nitrogen Division. Its three plants are strategically located for fast shipment to fertilizer manufacturers, with the aid of the largest fleet of tank cars in the industry plus many tank trucks. A widespread network of "in-transit" storage points is maintained, where fully-loaded tank cars sit on railroad sidings ready to move immediately for fast deliveries.

All Nitrogen Division facilities are closely linked by teletype, direct private phone and other methods of rapid communication. Every provision is made to expedite your orders—to get your nitrogen rolling to you immediately.

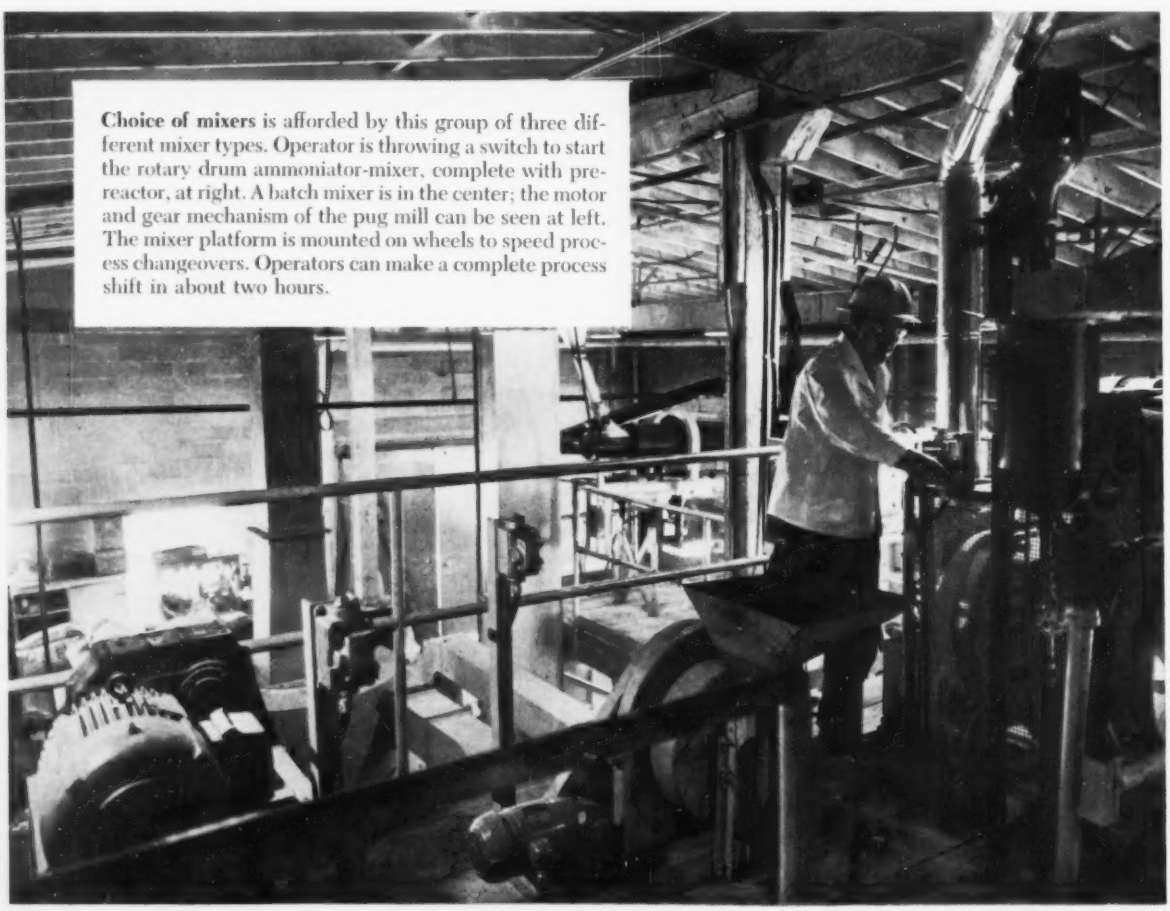
Nitrogen Division has the products and the people to serve you best! Why not see how well this service operates? Contact: Nitrogen Division, Allied Chemical, 40 Rector Street, New York 6, N. Y. Phone: Hanover 2-7300. Or call one of the 12 other offices listed on page 4 of this issue of ARCADIAN NEWS.

No Production Problem Too Tough For Modernized Fertilizer Pilot Plant

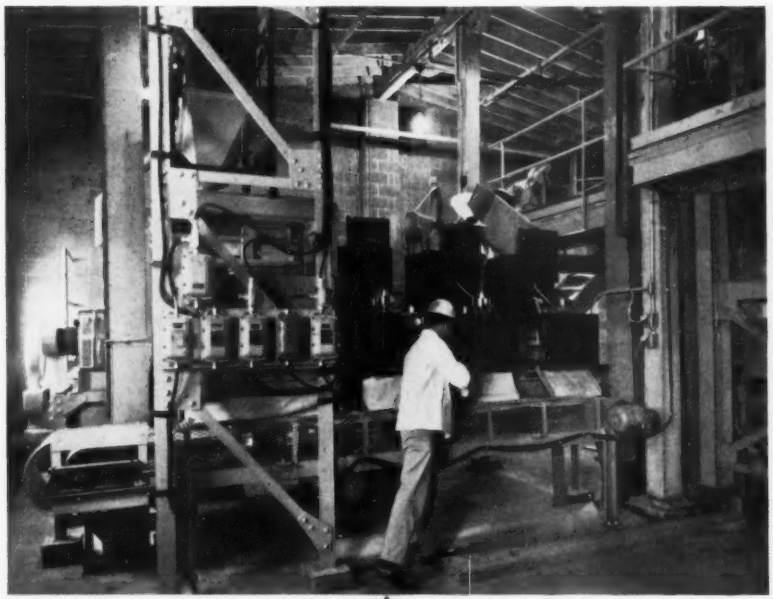
Nitrogen Division's technical service facility at Hopewell, Virginia, can cope with every type of process problem ...experiment with new techniques!

Mixed-goods producers now have a better-than-ever source of aid and guidance in Nitrogen Division's enlarged and modernized fertilizer pilot plant. In a compact but complete operation, the Hopewell pilot plant can produce any type of mixed fertilizer to order... simulate the working procedures of any manufacturer. All of the production equipment common to the industry is available, and can be used in any way to reproduce, correct or pioneer a product condition... or even create a completely new mixed fertilizer! The key to this versatile operation is a built-in mobility. An entire section of the equipment—the platform holding three different types of mixers—is on wheels to facilitate changing from one production technique to another.

This highly flexible pilot plant facility, coupled with the wealth of experience and high competence of Nitrogen Division chemical engineers, chemists and technicians makes the famous Nitrogen Division Technical Service more valuable than ever to fertilizer producers. For complete details—without obligation—write to Technical Service, Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N.Y.

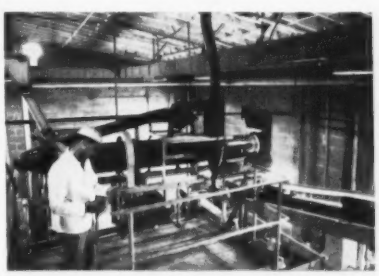


Choice of mixers is afforded by this group of three different mixer types. Operator is throwing a switch to start the rotary drum ammoniator-mixer, complete with pre-reactor, at right. A batch mixer is in the center; the motor and gear mechanism of the pug mill can be seen at left. The mixer platform is mounted on wheels to speed process changeovers. Operators can make a complete process shift in about two hours.

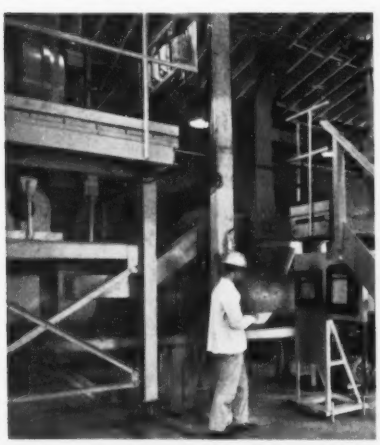


Continuous mixed fertilizer production begins here, at the solid feeder station. Man above is loading superphosphate into a measuring bin, as man below takes a weight sample for checking. Solid materials feed from measuring bins downward to a moving belt that goes off at right to the mixer. The sloping hopper, at top left, contains screens that separate fines, on-size and coarse granules. On-size goes to bagged or bulk storage; coarse proceeds to the crusher, and then recycles to the screens; fines go directly to the moving belt for recycling to the mixer.

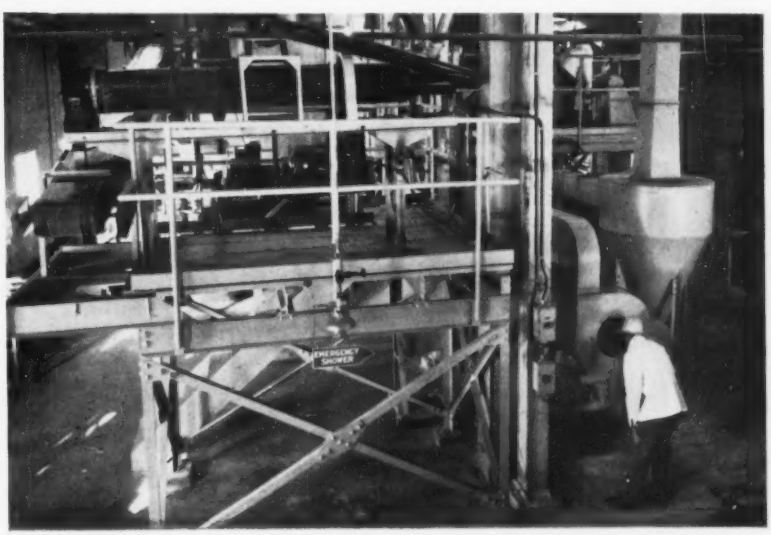
Liquid feeder station gives convenient centralized control over the flow of various liquids—water, nitrogen solution, acid—to the pre-reactor and mixer.



Operator checks a sample for temperature before mix enters the cooler through duct at left. Mix travels through cooler to output end at right, losing about 50 degrees of heat before it drops to a moving belt climbing to the screens.



View of processing area shows mixer platform structure at left. Extra granulator for optional use is directly beneath rotary ammoniator-mixer. Note wheels and floor tracks that make the mixer structure easy to move for process changes.



Overall view shows compact design of pilot plant. Technician in foreground is peering into dryer. Funnel shaped equipment next to dryer is the dust collector. Above and behind this is the mixer platform, where a man is checking the pug mill. The long, cylindrical object just above center is the cooler, next stop for the mix after it leaves the dryer. The top of the solid feeder station can be seen in the area beneath the cooler.

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	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
	Total Nitrogen	Anhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60°F	Approx. Vap. Press. at 104°F per Sq. In. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA®									
2	41.0	22.2	65.0	—	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	—	12.0	12.7	1.083	25	-36
3MC	47.0	29.7	64.5	—	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	—	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	—	5.5	11.2	1.134	22	1
URANA®									
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-S®									
A	45.4	36.8	—	32.5	30.7	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	13.5	0.978	48	46
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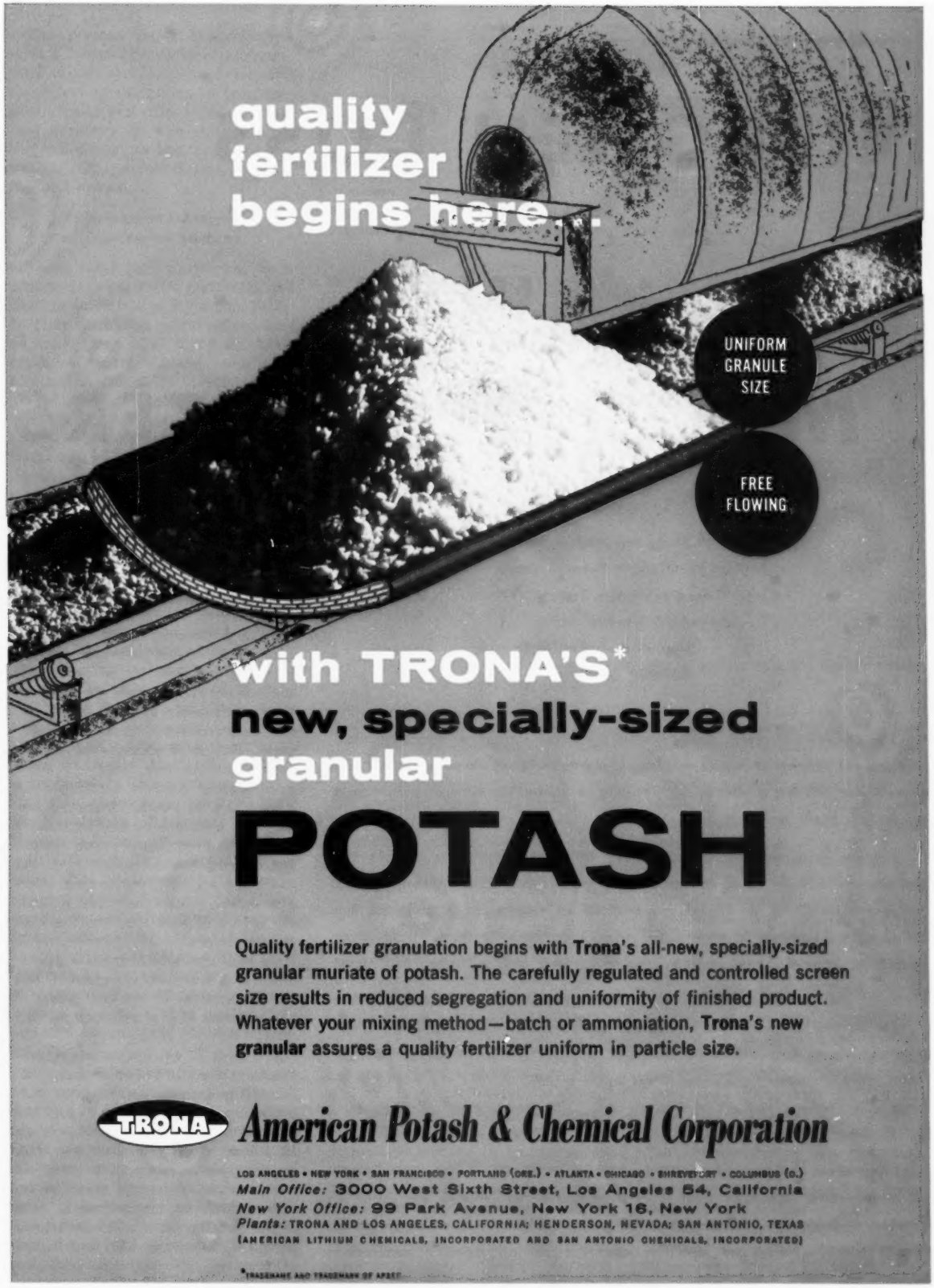
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The effect of some processing and storage conditions on

NITROGEN LOSS FROM MIXED FERTILIZERS

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The comparatively recent development of continuous methods of processing mixed fertilizers and the use of high proportions of ammoniating solutions containing heat-sensitive salts have led to considerable difficulty in maintaining nitrogen guarantees of high-analysis mixed fertilizers.

Nitrogen losses were studied in 1-1-1 ratio fertilizers formulated to simulate mixtures processed with the use of different ammoniating solutions. The mixture formulated with ammonium nitrate but without urea exhibited no nitrogen loss when heated in a 140° C. (284° F.) over for 95 minutes, the one with urea but without ammonium nitrate lost 3.0% of the total nitrogen in 90 minutes, and the one with both ammonium nitrate and urea lost 8.7% in 45 minutes.

The mixture formulated with ammonium nitrate but without urea underwent self-sustaining thermal decomposition at about 200° C. (392° F.) when slowly heated at 190° C. (374° F.) when rapidly heated, and as low as 162° C. (324° F.) when rapidly heated after treatment with 4% of sulphuric acid. The mixture which decomposed at 200° C. lost 83.8% of its nitrogen.

The presence of sulphuric acid in proportions up to 2% did not cause loss of nitrogen from mixtures formulated either with ammonium nitrate or urea, and stored at atmoshpheric temperature for one month. Choice of the type of ammoniating solution, effective neutralization of free acid, and temperature control (especially when acids are used) are important factors in preventing decomposition and nitrogen loss during processing of mixed fertilizers.

Nitrogen loss from high analysis mixed fertilizer, whether attributed to processing or storage conditions, is well documented in the technical literature (**1, 3-5, 7-11, 13-16**). During the processing of such mixtures, part or all of the nitrogen requirement is supplied by ammoniating solutions which contain in addition to water various proportions of ammonia, ammonium nitrate, and (or) urea. Ammonia-ammonium nitrate and ammonia-urea solutions have been widely used in fertilizers for more than 20 years. Ammonia-ammonium nitrate-urea solutions have come into prominence more recently. Among the advantages of the latter are a high fixed-to-free nitrogen ratio without adverse salting-out effects in cold weather, the high mutual solubility of ammonium nitrate and urea which enables granulation at a low moisture content, and the production of mechanically-stable granules of low caking tendency (**7, 13-14**).

The heat of neutralization of ammonia and sulfuric acid is frequently used to provide an adequate processing temperature during the granulation of mixed fertilizers (**6, 12**). Poor distribution of the acid, or improper mixing may interfere with neutralization and result in localized high concentrations of acid in the final product. Industrial experience has shown that hot lumps of material in mixtures prepared with ammonium nitrate give rise to rapid increase in temperature during processing and storage with at-

tendant decomposition and loss of nitrogen (**11, 15**).

The present paper is concerned with a laboratory study of ammoniated mixed fertilizers to determine the effect of variations in temperature, time, and the moisture and acid contents on the initiation of thermal-decomposition reactions involving nitrogen loss during processing and storage.

Preparation and Analysis of Experimental Mixtures

Three 1-1-1 ratio fertilizers were prepared from solid materials according to formulas shown in Table 1. They simulated mixtures processed with the use of three different types of ammoniating solutions. Mixture A (12-12-12) simulated the use of ammonia-ammonium nitrate, B (12-12-12) ammonia-urea, and C (15-15-15) ammonia-ammonium nitrate-urea solutions. All of the solid ingredients were pre-ground to pass a 35-mesh sieve in order to facilitate accuracy of formulation, good sampling, and uniformity in analyses of the mixtures. Pre-ammoniated superphosphates of known nitrogen contents, rather than superphosphate and ammonia separately, were also used in order to avoid loss of nitrogen through incomplete absorption of ammonia during preparation of the mixtures. Ammonium sulphate was included in Mixtures A and B (Table 1) because it is often used as a solid nitrogen carrier or is produced **in situ** when sulfuric acid is included in the formula (**6, 12**). Potassium chloride supplied the K_2O requirement in all three mixtures. Mixtures A and B were prepared with 7.05 units N as ammonium nitrate and urea, respectively, but were otherwise formulated similarly. Mixture C was prepared with ammonium nitrate and urea in the weight ratio of 54/46 which corresponds to the proportion of these salts in the saturated solution which exhibits the maximum volume of liquid phase per unit volume of water (**7**).

Kilogram batches of each mixture were tumbled in a twin-shell blender for 10 minutes, and three representative samples of each batch were analyzed chemically to determine the adequacy of mixing. Good mixing and precision in analyses were indicated by comparatively small deviations in mean results of analyses of the unheated samples and the mean nutrient ratios observed in Tables 2 and 4.

The methods of analysis were the official A.O.A.C. procedures (**2**), except that the Yee-Davis procedure (**17**) was used to determine urea nitrogen and ammoniacal nitrogen on samples containing urea. Nitrate nitrogen was determined as the difference between total nitrogen and ammoniacal nitrogen or total nitrogen and urea-plus-ammoniacal nitrogen, as applicable.

Table 1. Formulation

Material[1] Kind	Analysis, % Nitrogen	Total P_2O_5	Available P_2O_5	K_2O	Pounds per Ton	Plant Nutrient Units N	P_2O_5	K_2O
(Mixture A. 12-12-12)								
Ammoniated triple superphosphate	7.60	46.10	41.74	.....	232	0.88	4.84	.....
Ammoniated ordinary superphosphate	4.83	21.33	20.45	.....	716	1.73	7.32	.....
Ammonium nitrate	34.81	.....	.....	.....	405	7.05	.....	.....
Ammonium sulfate	20.55	.....	.....	.....	243	2.50	.....	.....
Potassium chloride	.....	.....	.....	60.20	404	.....	.....	12.16
					2000	12.16	12.16[2]	12.16
(Mixture B. 12-12-12)								
Ammoniated triple superphosphate	7.60	46.10	41.74	.....	232	0.88	4.84	.....
Ammoniated ordinary superphosphate	4.83	21.33	20.45	.....	716	1.73	7.32	.....
Urea	46.28	.....	.....	.....	305	7.05	.....	.....
Ammonium sulfate	20.55	.....	.....	.....	243	2.50	.....	.....
Potassium chloride	.....	.....	.....	60.20	404	.....	.....	12.16
Clay filler	.....	.....	.....	.....	100	.....	.....	.....
					2000	12.16	12.16[2]	12.16
(Mixture C. 15-15-15)								
Ammoniated triple superphosphate	4.52	46.80	42.73	.....	605	1.37	12.93	.....
Ammoniated ordinary superphosphate	5.49	19.56	15.81	.....	271	0.74	2.14	.....
Ammonium nitrate	34.68	.....	.....	.....	348	6.03	.....	.....
Urea	46.28	.....	.....	.....	298	6.90	.....	.....
Potassium chloride	.....	.....	.....	63.34	478	.....	.....	15.14
					2000	15.04	15.07[2]	15.14

[1] Each material was ground to pass a 35-mesh Tyler sieve.

[2] The ammoniation rates, as lbs. of ammonia per unit of available P_2O_5 are: Mixtures A and B, 5.3; Mixture C, 3.4.

Non-Self-Sustaining Thermal Decomposition

Portions of each mixture were subjected to various heat treatments. Some of the treatments simulated normal industrial processing situations where heat generated in the mixture may be sufficient to cause some decomposition and nitrogen loss but insufficient to initiate self-sustaining thermal decomposition. The severest heat treatment applied to a mixture in this series of tests was 140° C. for 95 minutes. This temperature approximated the maximum that would be expected during normal industrial operation (**11**), but the period of heating was somewhat longer. Where nitrogen loss was evident at 140° C. in less than 95 minutes, the 95-minute period of heating was omitted.

Fifty-gram samples of the mixtures, wetted to either 5 or 10 percent moisture content to approximate the expected moisture requirements for granulation, were heated in uncovered Petri dishes at oven temperatures of 100° to 140° C. for periods ranging from 15 to 95 minutes. After treatment the samples were dried, weighed, ground to pass a 35-mesh sieve, mixed, and analyzed. The results are given in Table 2.

The loss of nitrogen (column 15) was determined on the basis of decrease in the total N/total P_2O_5 ratio of the sample as a result of the treatment. The loss of volatile matter (column 16) during the treatment was determined on the dry basis and represents the difference between observed loss in weight of the sample during the treatment and its initial free-water content. The free-water content was determined from the loss in weight of a 5-gram sample during vacuum desiccation at room temperature. The nitrogen content of the volatile matter lost (last column) was calculated from the above data.

Mixture (A): Nitrogen derived

from ammonia-ammonium nitrate-ammonium sulfate. Samples 1 to 3 were not heated. Mean analyses of these together with the equivalent average deviations from the means are given in Table 2.

Sample 4, containing 10 percent moisture, heated at 140° C. for 95 minutes gave no evidence of nitrogen loss. A loss of 1.3 percent of the sample by volatilization of non-nutrient products other than free-water was observed.

Mixture (B): Nitrogen derived from ammonia-urea-ammonium sulfate. Mean analyses of unheated samples 5 to 7 are given in Table 2 accompanied by the average deviation from the mean in each case.

Sample 8, containing 10 percent moisture, heated at 140° C. for 90 minutes lost 3.0 percent of its nitrogen through urea decomposition. The nitrogen lost was equivalent to 10.6 percent (3.0 x 12.38/3.5) of the total loss in weight of the sample. Ammonia released by urea decomposition was partially retained in the sample as indicated by the increase in ammoniacal nitrogen content. In relation to total P_2O_5 content, ammoniacal nitrogen increased by 17.6 percent and urea nitrogen decreased 21.6 percent from the initial values of 5.06 and 7.39 percent, respectively, for the unheated mixture. Thus, 56 percent (17.6x5.06x100/21.6x7.39) of the nitrogen equivalent to the decrease in urea was retained as ammoniacal nitrogen. The reduction in water-soluble and available P_2O_5 contents indicated reversion of P_2O_5 in superphosphates to more basic forms.

Mixture (C): Nitrogen derived from ammonia-ammonium nitrate-urea. Sample 9 to 11 were not heated. Samples 12 to 14, 15 and 16, and 18, containing 5 percent moisture, heated at 100° C. for 45 minutes, 120° C. for 30 minutes, or 140° C. for 15 minutes, respectively, lost no nitrogen. Nitrogen loss, however, through urea decomposition progressively increased when the samples were heated at 120° C. for 45 minutes, 140° C. for 30 minutes, or 140° C. for 45 minutes (Samples 17, 19, and 20, respectively). Loss of nitrogen ranged from 1.1 to 8.7 percent and amounted to 7.0 to 24.1 percent of the total loss in weight. In relation to the total P_2O_5 contents the ammoniacal nitrogen increased 10 percent and the urea nitrogen decreased 27.7 percent in Sample 20 heated at 140° C. for 45 minutes. In this case the increase in ammoniacal nitrogen was equivalent to only 28.1 percent (10.0x5.24x100/27.7x6.73) of the decrease in urea nitrogen. This is approximately half of the 56 percent retention observed in the case of Mixture B, Sample 8, formulated without ammonium nitrate and heated at 140° C. for 90 minutes. The water-soluble P_2O_5 and urea contents of Samples 12 to 20 progressively decreased as the temperature and/or period of heating increased. The two more rigorously treated samples (19 and 20) decreased in available P_2O_5. The observed losses of volatile matter (Table 2), although not consistently in agreement with the analyses of the heated mixtures, nevertheless confirm the considerable shrinkage in weight of fertilizer materials which may occur during commercial processing of mixtures.

Self-Sustaining Thermal Decomposition

Heating of Mixture A, containing nitrogen derived from ammonia, ammonium nitrate and ammonium sulfate, in an oven ranging from 180° to 202° C., led to self-sustaining

Table 2. Effect of Processing Temperature on the Nutrient Status of Fertilizer Containing Ammonium Nitrate and Urea.

Sample Number	Sample Treatment		Nutrient Analysis, % (Dry Basis)									Nutrient Ratios		Portion of Total N Lost	Loss of Volatile Matter	N Content of Volatile Matter Lost
			Nitrogen				P_2O_5				K_2O					
	Temp. °C.	Time min.	Total	Urea	Ammoniacal	Nitrate	Total	Citrate Insol.	Available	Water Sol.		Total N/T.P_2O_5	K_2O/T.P_2O_5			
														— % (Dry Basis) —		
Mixture A. 12-12-12 with ammonium nitrate																
1,2,3[1]			12.00		8.57	3.43	12.95	.31	12.64	5.36	12.16	.93	.94			
EAD[2]			.07		.07	.04	.03	.02	.05	.06	.11	.01	.02			
4	140	95	12.34		8.79	3.55	13.15	.40	12.75	5.43	11.83	.94	.90	none	1.3	none
Mixture B. 12-12-12 with urea																
5,6,7[1]			12.38	7.39	5.06		13.67	.37	13.30	5.10	12.28	.91	.90			
EAD[2]			.02	.05	.04		.09	.05	.14	.05	.02	.00	.00			
8	140	90	12.03	5.80	5.96		13.69	.94	12.75	2.55	12.36	.88	.90	3.0	3.5	10.6
Mixture C. 15-15-15 with ammonium nitrate and urea																
9,10,11[1]			14.92	6.73	5.24	2.95	16.88	1.09	15.79	8.82	15.14	.88	.90			
EAD[2]			.04	.11	.11	.17	.11	.02	.11	.07	.13	.01	.01			
12,13,14[3]	100	15-45	15.02	6.76	5.34	2.92	16.78	.96	15.81	8.33	15.17	.90	.90	none	0.4	none
15,16[4]	120	15-30	15.07	6.71	5.33	3.03	16.90	.99	15.91	8.60	15.21	.89	.90	none	1.0	none
17	120	45	14.92	6.12	5.66	3.14	17.06	.89	16.17	6.62	15.20	.87	.89	1.1	2.3	7.0
18	140	15	15.24	6.81	5.40	3.03	17.07	1.14	15.93	8.04	15.01	.89	.88	none	1.0	none
19	140	30	14.69	5.83	5.75	3.11	17.36	1.38	15.98	5.96	15.33	.85	.88	4.3	3.4	18.5
20	140	45	14.19	5.07	6.00	3.12	17.58	1.45	16.12	5.10	15.52	.81	.88	8.7	5.4	24.1

[1] Unheated samples. The results given are mean values.

[2] The Equivalent Average Deviation is the square root of the quantity obtained by dividing the sum of the squares of the individual deviations from the mean by the number of observations. EAD = $\sqrt{\text{sum } d^2/n}$, n = 3.

[3] Samples heated 15, 30, and 45 minutes, respectively. The results given are mean values.

[4] Samples heated 15 and 30 minutes, respectively. The results given are mean values.

thermal decomposition and nitrogen loss. The effect of variation in temperature, moisture and acid contents, during slow or rapid heating of the mixture was investigated. Slow heating of the mixture was accomplished by oven-heating in Dewar flasks, and rapid heating by oven-heating in Erlenmeyer flasks. Decomposition products were trapped in a collection flask connected to the stoppered sample-flask by glass tubing extending through the oven wall. Sample temperature was continuously recorded by means of a glass-enclosed iron-constantan thermocouple inserted in the sample, and a recording potentiometer.

Slow heating. One hundred gram portions of the mixture containing 0.9 percent moisture were heated in Dewar flasks at oven temperatures ranging from 180° to 202° C. The results are summarized in Table 3.

Sample 21, heated in a 180°-190° C. oven attained 180° C. in 23 hours, and lost 2.1 percent of its nitrogen and 1.1 percent of its initial weight exclusive of free-water, without undergoing self-sustaining thermal decomposition. Sample 22 heated in a 198°-202° C. oven decomposed vigorously at 196° C. after 16 hours, and Sample 23 heated somewhat more rapidly at the same oven-temperature setting decomposed at 206° C. after 11 hours. Both samples exhibited exotherms of a few degrees at about 190° C. Sample 22 which decomposed at 196° C. lost 83.8 percent of its nitrogen and 31.8 percent of its weight.

The development of acidity during heat treatment was determined on different samples of Mixture A which were slowly heated from 30° C. up to temperatures ranging from 116° to 196° C., and cooled. The sample which decomposed at 196° attained a maximum temperature of 315° C. The pH of each sample was then measured at room temperature on an equilibrium mixture of two parts of water and one part of cooled sample. The samples exhibited the following pH values after being heated to the indicated temperature: 4.4, 30°; 4.2, 116°; 3.9, 148°; 3.5, 180°; and 3.1, 315°. Thus acidity increased with increasing temperature and attained a maximum in the decomposed sample.

Rapid heating. One hundred-gram samples of Mixture A containing from 0.9 to 10.8 percent moisture (Samples 24 to 26), heated in Erlenmeyer flasks at oven temperatures of 180°-200° C., decomposed at 190° C. in 96 to 396 minutes (Table 3). It will be recalled that the more slowly heated samples of Mixture A exhibited slight exotherms at this temperature. The rather wide variation in the time (96-396 minutes) required to reach decomposition temperature was attributed to the effect of variations in initial moisture contents on the rate of temperature increase.

Table 3. The Self-Sustaining Thermal Decomposition of Mixed Fertilizer Containing Ammonium Nitrate (Mixture A).

Sample			Range of Oven Temperature °C.	Initial Increase in Sample Temperature[1] °C.	Self-Sustaining Decomposition		
No.	H_2O Content %	H_2SO_4 Content lb./ton			Time Required For Initiation	Started at °C.	Reached °C.
			Slow Heating				
21	0.9	none	180-190[2]	—	[3]	[3]	(180°)[3]
22[4]	0.9	none	198-202	110	16 hrs.	196	301
23[4]	0.9	none	198-202	115	11 hrs.	206	315
			Rapid Heating				
24	0.9	none	180-200[5]	65	270 min.	190	309
25	10.8	none	180-200[5]	73	396 min.	190	296
26	5.5	none	188-192	110	96 min.	190	302
			Excess Acid and Rapid Heating				
27	5.2	20	192-196	85	93 min.	194	306
28	4.8	20	192-196	83	89 min.	189	298
29	4.8	20	192-196	86	105 min.	179	302
30	4.9	20	198-202	106	41 min.	165	292
31	4.8	40	192-196	87	103 min.	184	308
32	5.0	40	198-202	97	69 min.	178	293
33	5.4	40	198-202	obscured	51 min.	178	292
34	3.9	80	196-200	97	56 min.	177	297
35	4.1	80	198-202	106	27 min.	162	284

[1] The increase in sample temperature over the first 3 hours of heating for the slowly heated samples, and over the first 18 minutes for the rapidly heated samples.

[2] Oven temperature was increased to 190° to facilitate the attainment of a sample temperature of 180°. Analysis of sample indicated a 2.1% loss of nitrogen.

[3] Did not undergo self-sustaining decomposition.

[4] Samples 22 and 23 indicated a slight exotherm at 190°. Analysis of No. 22 indicated a loss of nitrogen of 83.8%.

[5] The oven temperature was increased to 200° when the sample temperature did not appear to be increasing sufficiently to initiate decomposition.

On heating the mixtures by the rapid procedure a greenish-yellow solution appeared in the collection flask as the sample temperature increased from 140° to 168° C. It had a pH of about 8.0, an odor resembling chlorine, and contained ammonium and chloride ions but no nitrate. At about 180° C. a white crystalline substance, identified as impure ammonium chloride, condensed on the wall of the flask containing the sample. At about 183° C. a gas was liberated. At 190° white fumes were rapidly evolved and the solution in the collection flask became basic momentarily. The self-sustaining decomposition proceeded with rapid evolution of white fumes and the appearance of a greenish-yellow solution in the collection flask. The vigorous decomposition lasted about 5 minutes, with an increase in sample temperature of more than 100° C. After the reaction subsided the trapped greenish-yellow solution rapidly became colorless. This solution was strongly acidic (pH 2) and contained ammonium, chloride, chlorate, and nitrate ions.

The presence of ammonium chloride in the condensate during the early stages of heating (140°168° C.) and its observed sublimation at 180° C. indicates how nitrogen may be lost before the onset of the rapid self-sustaining decomposition at 190° C. The observed sublimation of ammonium chloride at about 180° C. corresponded with the determined loss of nitrogen of 2.1 percent at this temperature noted on the more slowly heated Sample 21 of Mixture A.

Effect of excess acid. The neutralization reaction of ammonia and sulfuric acid provides useful heat for granulation (**6, 12**), but the limitations of practical control increase the probability that excesses of unneutralized acid and localized overheating may occur during processing. In order to determine the effect of excess acid on the temperature at which self-sustaining decomposition occurs, portions of the ammonium nitrate mixture after adjustment to 5 percent moisture and 1, 2, and 4

Table 4. Effect of Sulphuric Acid on the Nutrient Status During Storage of Fertilizers Prepared with Ammonium Nitrate or with Urea.

Sample No.	Sample Treatment		Nitrogen, % (Dry Basis)				P_2O_5, % (Dry Basis)				K_2O (%, Dry Basis)	Nutrient Ratios	
	Acid lb./ton	Storage Weeks	Total	Urea	Ammoniacal	Nitrate	Total	Citrate Insol.	Available	Water Soluble		Total N/ Total P_2O_5	K_2O/ Total P_2O_5
Mixture A. 12-12-12 with ammonium nitrate													
36,37,38[1]	none		11.92		8.71	3.20	13.67	.27	13.41	5.18	12.18	.87	.89
EAD[2]			.05		.10	.09	.05	.05	.02	.02	.01	.00	.00
39[3]			11.80		8.62	3.17	13.53	.27	13.28	5.13	12.06	.87	.89
39a,b,c,d[1]	20	0,1,2,4	12.03		8.58	3.45	13.29	.25	13.04	6.23	12.08	.91	.91
EAD[2]			.09		.07	.05	.15	.07	.10	.02	.02	.01	.01
40[3]			11.69		8.54	3.14	13.40	.26	13.15	5.08	11.94	.87	.89
40a,b,c,d[1]	40	0,1,2,4	11.99		8.48	3.51	13.05	.24	12.81	6.92	12.08	.92	.93
EAD[2]			.12		.05	.08	.04	.06	.08	.08	.08	.01	.01
Mixture B. 12-12-12 with urea													
5,6,7[1]	none		12.38	7.39	5.06		13.67	.37	13.30	5.10	12.28	.91	.90
EAD[2]			.02	.05	.04		.09	.05	.14	.05	.02	.00	.00
41[3]			12.26	7.32	5.01		13.53	.37	13.16	5.05	12.16	.91	.90
41a,b,c,d[1]	20	0,1,2,4	12.19	7.10	5.04		13.38	.33	13.06	6.06	12.13	.91	.90
EAD[2]			.05	.09	.06		.05	.06	.06	.04	.04	.01	.01
42[3]			12.14	7.25	4.96		13.40	.36	13.04	5.00	12.04	.91	.90
42a,b,c,d[1]	40	0,1,2,4	12.08	6.98	4.99		13.15	.28	12.87	6.80	12.19	.92	.93
EAD[2]			.04	.10	.03		.05	.05	.14	.15	.04	.00	.01

[1] The mean analysis of three untreated samples, or four treated samples (a,b,c,d), as applicable.
[2] Footnote 2 of Table 2 applies.
[3] The mean analyses of the untreated samples are adjusted for the acid addition

percent of sulfuric acid (20, 40, and 80 lbs. H_2SO_4/ton of mixture) were heated at oven temperatures ranging from 192° to 202° C. by the rapid-heating procedure. Self-sustaining decomposition occurred at 162° to 194° C. in from 27 to 105 minutes (Table 3) depending on the conditions of the treatment. Each of the samples (31 to 35) containing 2 or 4 percent excess acid, and two (29 and 30) of four samples containing 1 percent excess acid decomposed at substantially lower temperature than the rapidly heated unacidulated samples (24 to 26). The time required for the acidulated samples to attain decomposition temperature decreased as the range of oven temperature increased from 192°-196° C. to 198°-202° C. or from 196°-200° C. to 198°-202° C. At the highest acid content (80# H_2SO_4/ton of mixture) and the highest oven temperature (198°-202° C.) decomposition occurred at the lowest temperature, 162° C., after the shortest heating period, 27 minutes.

Storage Tests

The mixtures containing ammonia-ammonuim nitrate-ammonium sulfate (A), and ammonia-urea-ammonium sulfate (B) were each treated with dilute sulphuric acid to obtain contents of 1 and 2 percent of 100 percent acid in the fertilizer equivalent to 20 and 40 lbs. of acid per ton of Mixture. Each acidulated lot was thoroughly mixed, heated in a 100° C. oven for 30 minutes to simulate normal processing conditions, cooled, placed in a loosely-capped sample bottle, and analyzed immediately and after 1, 2, and 4 weeks storage at atmospheric temperature (25 -30° C.). No evidence of nitrogen loss nor other significant change in composition was observed as shown by the data on the a, b, c and d portions of samples 39, 40, 41 and 42 in Table 4. The water-soluble P_2O_5 contents increased initially (0 week) owing to the acid additions to the mixtures but did not change significantly on storage.

Conclusions

Mixtures prepared with both ammonium nitrate and urea were more subject to nitrogen loss through non-self-sustaining decomposition at relatively high processing temperatures than mixtures prepared with either of these salts singly.

Mixtures prepared with ammonium nitrate but without urea, although stable at normal processing temperatures, exhibited extensive nitrogen loss through self-sustaining decomposition at temperatures of 190° C. and above. The presence of up to 4 percent unneutralized sulfuric acid decreased the temperature and time required for initiation of the decomposition reactions.

The presence of up to 2 percent of unneutralized sulfuric acid did not cause loss of nitrogen from mixtures prepared with either ammonium nitrate or urea, and stored at atmospheric temperatures for one month. Most nitrogen losses appear to occur during processing of mixtures. Choice of the type and proportion of ammoniating solution used, effective neutralization of free acid, and temperature control (especially when acids are used) are important factors in preventing decomposition and nitrogen loss during processing of mixtures.

Acknowledgement

The authors wish to thank Miss Dorothy Carroll of this laboratory for making many of the chemical analyses.

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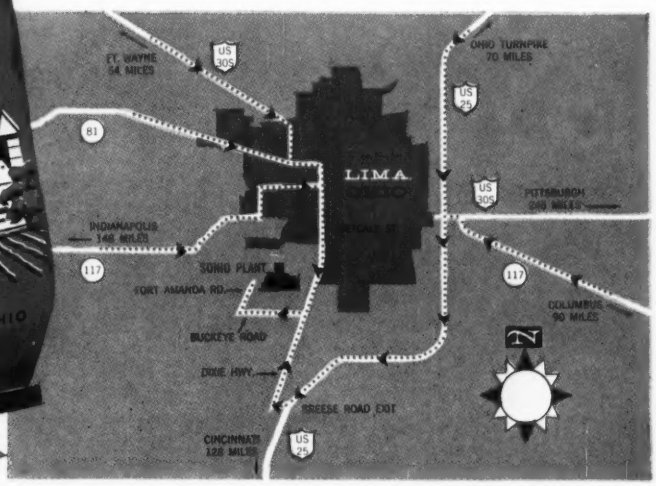

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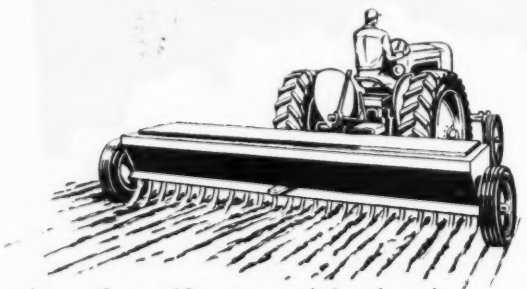

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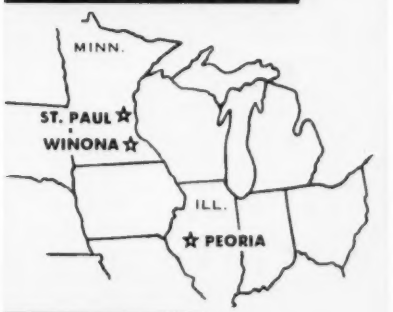

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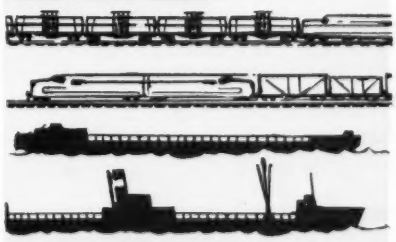

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Factors related to the

United States and Regional Demand for Fertilizer

by Earl O. Heady *and* Martin H. Yeh
Iowa State University

This report summarizes the results of a study directed to improve knowledge of the important variables affecting demand for fertilizers and fertilizer materials. The analysis was conducted for the United States, and the 10 census regions of the Nation. The results of this study compare the relative importance of knowledge about fertilizers, incorporated with time, the price of fertilizer, the price of crops, and farm income as they affect the amount of fertilizer used by American farmers.

Historic figures on fertilizer use are well known. However, some of the important regional differences have not been studied. These differences among regions provide the bases for the development of sound and forward looking fertilizer education programs. The important regional and national findings are presented below.

National and Regional Trends

Input of fertilizer in American agriculture has increased rapidly in the last three decades. While the increase has been especially rapid over the past 20 years, some upward trend was apparent even before the depression of the 1930's. Use of commercial fertilizer is now 300 percent greater than in 1926 (tons of fertilizer material). Annual sales of all commercial fertilizer increased from 7 million tons in 1926 to 22 million tons in 1956. The relative increase in consumption of plant nutrients has outpaced the use of all commercial fertilizers, on a tonnage basis, as indicated by the extent to which the analysis of fertilizer has been upgraded in recent years.

The total quantity of plant nutrients purchased by United States farmers in 1956 was over five times that of the 1926-30 average. In this same period, the quantity of phosphates (P_2O_5) purchased increased by three times, a percentage increase paralleling that for the tonnage of all commercial fertilizer. However, use of nitrogen (N) was six times that of the average for the 1926-30 period, while use of potash (K_2O) has increased five-fold.

Important differences have taken place in regional use of fertilizer. Prior to 1940, the heavy users of chemical fertilizer were the Northeast and Southern states. In 1910, the farmers in Northeast, Appalachian, Southeast and Delta regions used 93 percent of all chemical fertilizer used in the United States. In 1940, the farmers in these regions were still using 82 percent of the total chemical fertilizer consumed in the United States.

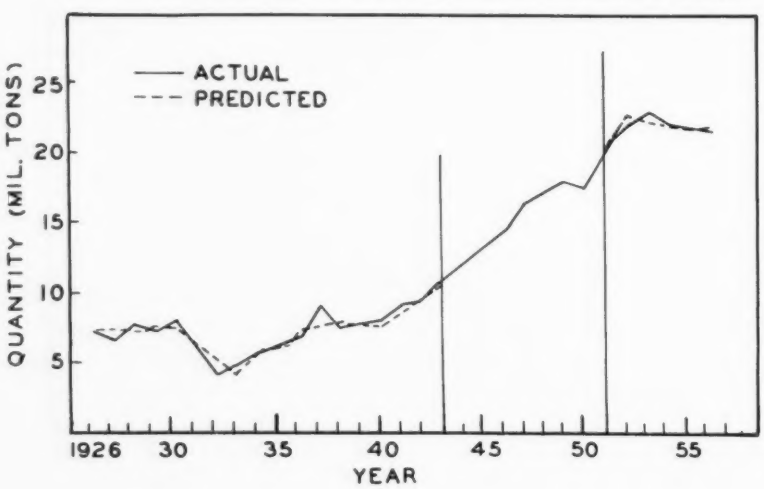
However, by 1956, they were using only 55 percent of the Nation's total fertilizers, although their use increased by 140 percent between 1940 and 1956. In contrast, however, use of fertilizer increased by 24-fold in the Northern Plains between 1940 and 1956. Relative increases in use of chemical fertilizers were almost as great in the Mountain and Pacific regions where consumption grew by 14- and 10-fold respectively, between 1940 and 1956. During the same period, use increased by over 600 percent in the Corn Belt, Lake States, and Southern Plains regions. On a regional basis, the Corn Belt was the largest user by 1956. While the Corn Belt and Lake States regions together used only 12 percent of the total fertilizer consumed in the United States in 1930 and 14 percent in 1940, the farmers in these two regions used 27 percent of all fertilizer in 1956.

In 1926, most of the fertilizer was used on more intensive cash crops such as cotton, tobacco, potatoes, fruits and vegetables. These crops are still important from the standpoint of fertilization. But less intensive crops such as corn, small grains, hay and pasture have become relatively more important; a fact which has been emphasized in the shift in regional patterns of fertilizer use.

Numerous factors have been important in the rapid increase in fertilizer use over the past two decades. Of these considerations, four technical factors appear to be most important. They are as follows:

(1) Development of improved crop varieties and related innovations which interact positively with fertilizer in increasing yields; **(2)** improved methods of applying ferti-

Figure 1. Use of Short-run Prediction Equation. Actual compared with Predicted Fertilizer Use for the U. S., 1926-56.



* This project was conducted cooperatively with the Tennessee Valley Authority under TVA Activity 865-41-13.

lizer, which allow a given amount of fertilizer to be transformed in crop yield at a higher rate; **(3)** depletion of the original stock of soil nutrients over time, resulting in a relatively greater crop response to applied nutrients; and **(4)** fertilizer research and education which provided farmers with greater knowledge of the response and profits forthcoming from fertilizer.

However, economic and institutional factors have also been important over the past two decades. The favorable income position of agriculture in postwar years provided increased amounts of capital for investment in purchased factors of production. Perhaps the most important consideration in this regard has been the decline in the relative price of fertilizer over the last two decades. The price of fertilizer, while increasing with the general price level in absolute magnitude, has declined relative to the price of farm crops and other factors of production.

Using the 1926-1930 averages as the base period, crop prices declined relatively more than fertilizer prices during the 1930's depression. However, after 1940, fertilizer prices did not increase as rapidly as crop prices, and the fertilizer/crop-price ratio has been at a more favorable level than during any other period of similar length. With a decrease in this ratio, use of greater amounts of fertilizer has become more profitable. The differences in use of fertilizer exist even though the real cost of fertilizer relative to crop prices has declined similarly for both all nutrients and regions in the United States. Therefore, variables other than fertilizer crop price ratios and historic quantities of fertilizer used would seem important. For this reason, time has been included as a variable in the analysis of fertilizer demand in order to reflect changes in knowledge of production techniques and in production relationships. Quite obviously, technical change and knowledge, provided gradually over time to farmers, have been important along with favorable price ratios in stimulating an increase in the use of fertilizers.

Predicting Equations

Several types of predicting equations or procedures were used in determining the relative importance of the different factors affecting use of fertilizer in the United States, and in the various regions. The period analyzed was 1926-56, excluding 1944-50, when demand generally exceeded capacity. One objective of the study was to determine the relative importance that such factors as the price of fertilizer, the price of crops, the level of farm income, and time result in an increase or decrease in the use of fertilizer.

Another objective was to determine how each of these factors may affect fertilizer use in the near future, and over a longer period when adjustments can be made in farming and the conditions surrounding agriculture and farmers' decision-making. The prediction equations derived from the study are presented in technical reports.* The review of the findings which result from them will be presented below. On the average, the variables used in the analysis of fertilizer demand explained about 95 percent of the "variance" in aggregate fertilizer use by farmers in the Nation, and in the various regions.

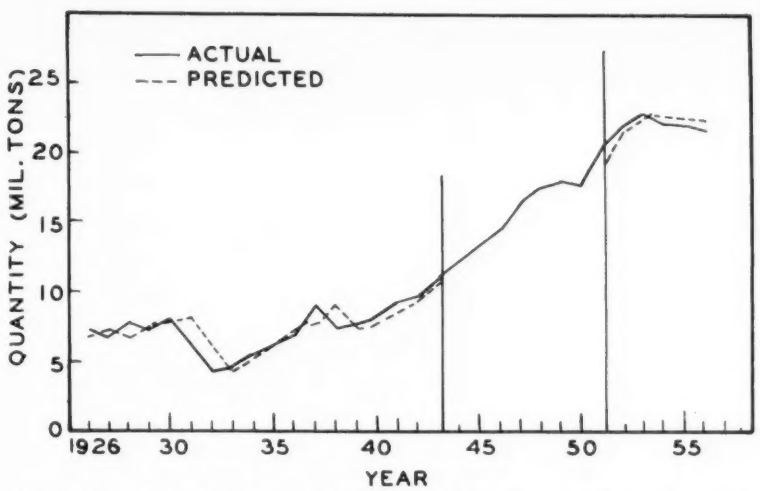


Figure 2. Use of Long-run Prediction Equation. Actual compared with Predicted Fertilizer Use for the U. S., 1926-56.

United States

Fertilizer and Nutrient Use

The most important single variable studied for the United States was the ratio of fertilizer prices to crop prices. This factor is computed by dividing the per unit price of fertilizer by the per unit price of crops. For example, if nitrogen is 12 cents per pound and corn is one dollar per bushel, the price ratio is 0.12 : 1.00, or 0.12. If nitrogen is 12 cents and corn is 80 cents per bushel, the ratio is 0.15. If nitrogen is 15 cents and corn is one dollar per bushel, the ratio also is 0.15. As this ratio goes up, fertilizer use decreases; a decrease in the ratio has the opposite effect. The ratio increases when the price of fertilizer goes up or the price of crops goes down. It decreases when fertilizer price decreases, or crop price increases.

The data indicate that as an average over time for the United States, a one percent change in the price ratio of a given fertilizer price at planting time in a selected year, and the crop price in the previous year related to fertilizer consumption in the selected year, results in a long-run change of -1.23 percent in the amount of fertilizer used. Hence, if the price ratio increases by one percent, either from an increase in fertilizer prices or a decrease in crop prices, fertilizer consumption is predicted to decrease by 1.23 percent. In contrast, a one percent decrease in the price ratio, caused by either a decline in fertilizer price or an increase in crop price, is predicted to result in an increase of fertilizer use by 1.23 percent over the long run.

These figures are based on the effect of the fertilizer/crop-price ratio alone, without regard to time which affects farmer use of fertilizer through knowledge, physical and economic environment. Over the long run, supposing that changes in farmer knowledge and customs with respect to fertilizer use continue to change as in the past, fertilizer consumption is predicted to increase about 1.3 percent per year (due to time alone, and in the absence of price changes). The two variables—time related to knowledge, and the price of fertilizer relative to the price of crops have both favored increases in fertilizer demand over the last decade.

From the analysis of the United States' demand for fertilizer, it is

* One technical report is scheduled to be published as an Iowa State University Agricultural Experiment Station Research Bulletin, and the other technical report is scheduled to be published as a journal article in the **Journal of Farm Economics.**

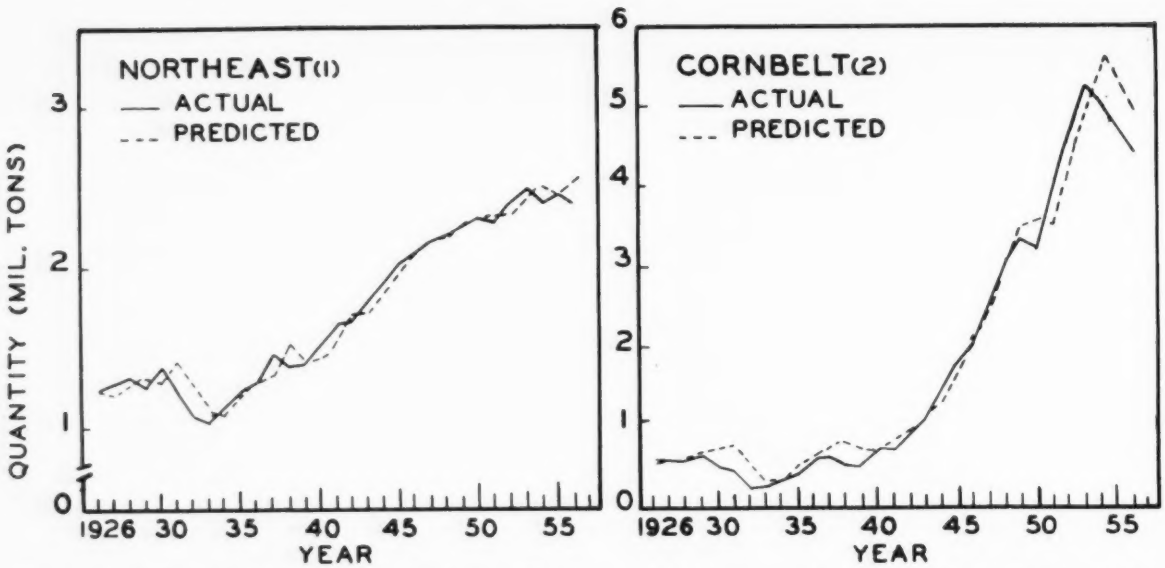


Figure 3 (1, 2). Use of Long-run Prediction Equation. Actual compared with Predicted Fertilizer Use for Northeast and Cornbelt Regions, 1926-56.

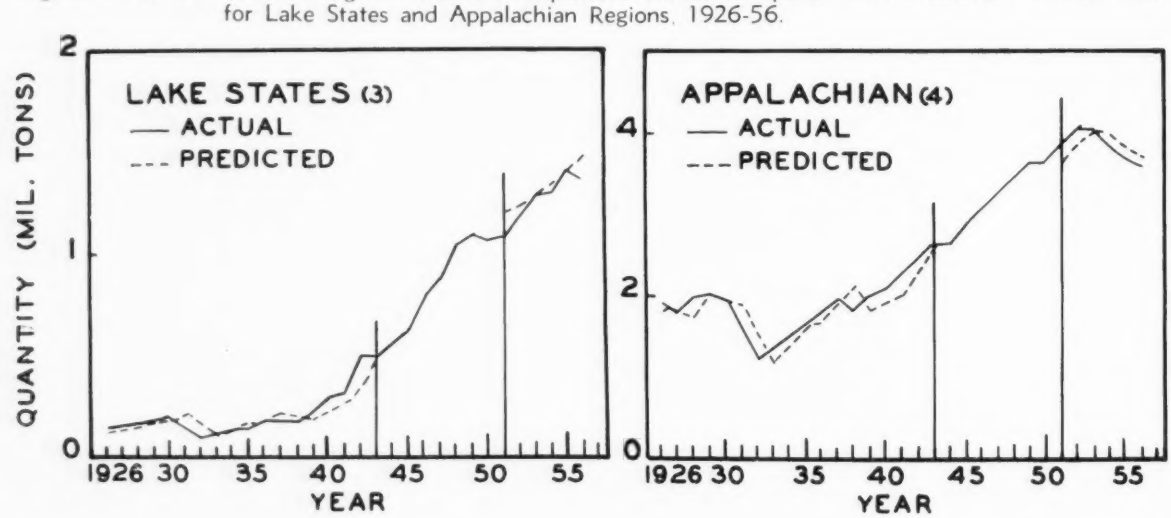
estimated that time, increased technical knowledge, and the cost of fertilizer relative to crops have been about equally important in their relative effect on total fertilizer use over the long run. In the practical programming of research and education, these results indicate that the efforts toward reducing the price of fertilizer nutrients through higher analysis materials, improved production processes, and the development of new and improved materials can make further important contributions to increased fertilizer use in the years ahead; that is, to the extent that these developments help to decrease the price of fertilizer relative to the price of crops, and to increase the economic efficiency in the use of fertilizers on the farm.

While both crop and fertilizer prices have increased due to inflationary forces over recent decades, fertilizer prices have declined relative to crop prices. This trend has been made possible by a complex of forces surrounding improved technology in fertilizer manufacture. While the price of fertilizer relative to the price of crops has been only slightly more important in the past than time and the knowledge factors, these latter factors will probably be more important in the future in affecting total fertilizer demand. This will occur since so much more is now known about fertilizer, and crop response to fertilizer applications; and a much greater proportion of farmers have this knowledge than in the past.

Looking at the effects of various factors on the demand for fertilizer in the short run, the following data are cited for the United States. The relationships presented below refer to a period short enough so that farmers do not have sufficient basis for adjusting their fertilizer use. Fertilizer prices are predicted to have a 0.5 percent effect on use; meaning that a one percent increase in fertilizer price, with crop prices and farm income remaining constant, will be associated with a decline of one half of one percent in fertilizer use in the United States.

In contrast, a one percent decline

Figure 3 (3, 4). Use of Long-run Prediction Equation. Actual compared with Predicted Fertilizer Use for Lake States and Appalachian Regions, 1926-56.



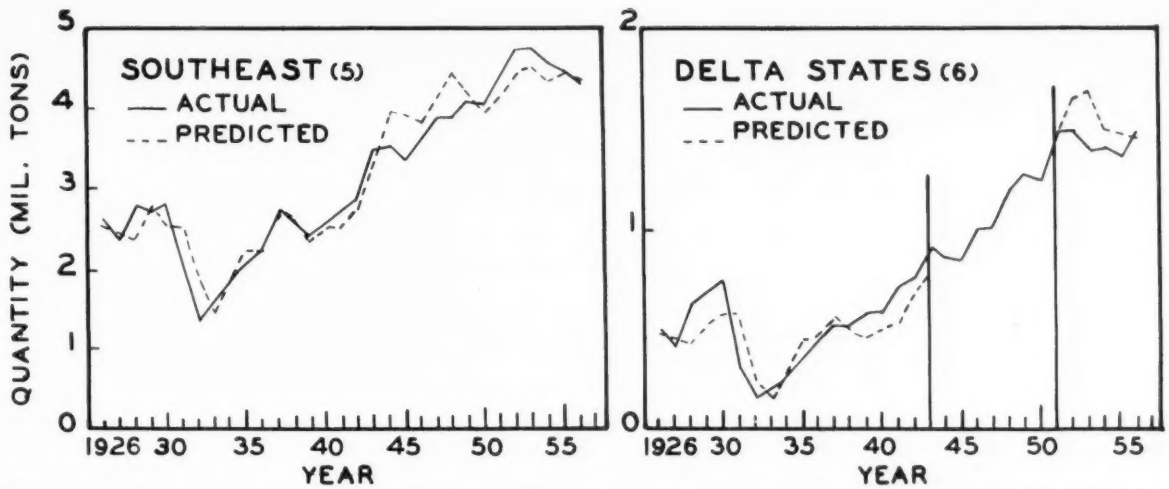


Figure 3 (5, 6). Use of Long-run Prediction Equation. Actual compared with Predicted Fertilizer Use for Southeast and Delta States Regions, 1926-56.

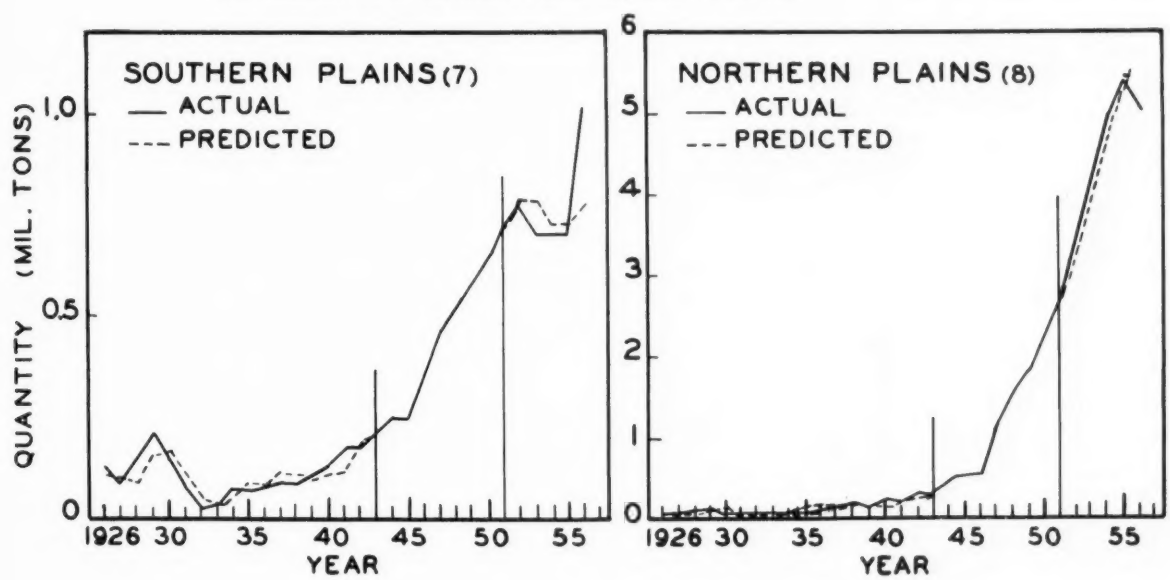
in fertilizer price, farm income, crop prices, and time or knowledge factors remaining constant, will result in an increase of fertilizer use by one half of one percent. Time, or the knowledge and custom factors which it represents, is predicted to have a much smaller effect. Fertilizer use has increased by about 0.08 percent for each one percent change in time — about 0.33 percent per year. Level of cash farm income, which actually is partly a compounding of crop prices, is predicted to have a 1.08 percent effect; that is, increase or decrease in fertilizer consumption by 1.08 percent for each one percent increase or decrease respectively, in farm income. For the long run figures cited above, the farm income effect is not included because the main effects are through the prices of crops and fertilizer. In the long run if income is too low, for example, farmers without the income and capital will leave their farms, and those with the resource will acquire the productive land.

Demand for Individual Nutrients in the United States

When viewed from the standpoint of individual nutrients in the form of nitrogen, phosphate, and potash, demand has been much more responsive to price than the aggregate demand for fertilizer. The findings presented above refer to all fertilizer measured in tons. On a tonnage basis, a decline in the fertilizer crop price ratio for individual nutrients has become much more effective in increasing consumption than a similar decline for fertilizer in total. This trend has occurred because of the availability, at lower cost and in new forms, of individual nutrients and high analysis mixtures.

The price effect is predicted to be greatest for nitrogen and smallest for P_2O_5. Similarly, the "time effect" is predicted to be two and one-half times greater for nitrogen than for P_2O_5, and twice as great for potash as for P_2O_5. With the passage of time, increased farmer knowledge, and the decline in the real price of fertilizer relative to crops, the aggregate United States mix of nutrients used

Figure 3 (7, 8). Use of Long-run Prediction Equation. Actual compared with Predicted Fertilizer Use for Southern and Northern Plains Regions, 1926-56.



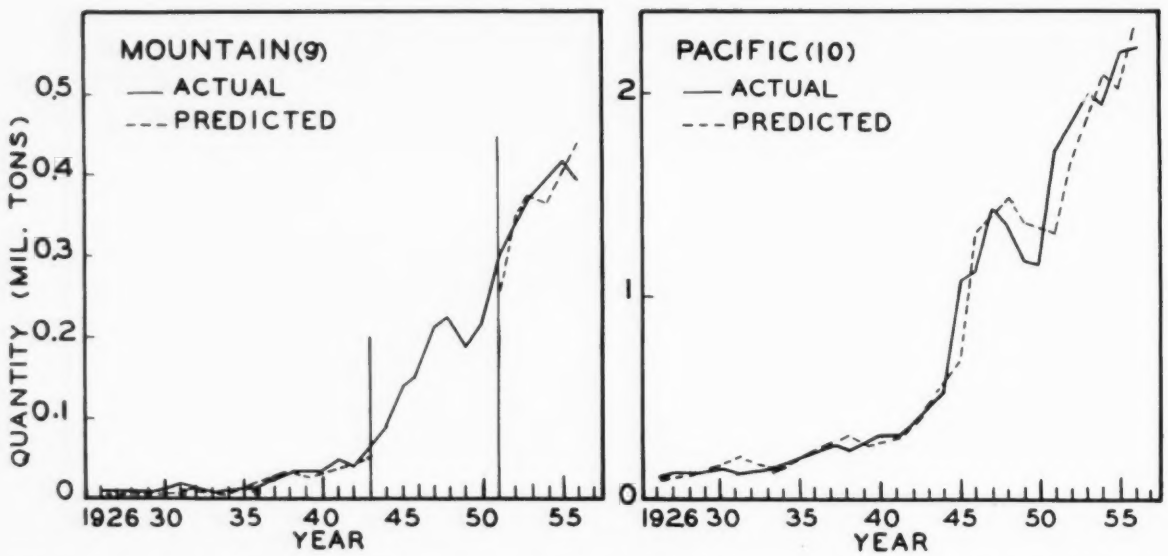


Figure 3 (9, 10). Use of Long-run Prediction Equation. Actual compared with Predicted Fertilizer Use for Mountain and Pacific Regions, 1926-56.

by farmers changed from an N-P-K ratio of 0.41-1.00—0.41 in 1926 to a 0.85-1.00—0.83 ratio in 1956. All three nutrients have nearly the same relative short run effects as affected by the level of farm income. The figures are 0.8 for nitrogen, 0.6 for P_2O_5, and 0.9 for potash; indicating the percentage change in nutrient use with a one percent change in income; nutrient use changing, of course, in the same direction as cash farm income.

Factors Affecting the Demand for Fertilizer by Regions

The long run effect of fertilizer crop-price ratios and time on fertilizer demand for the 10 regions are presented in Table 1. These variables "explained" as much as 99 percent of the fertilizer use in the Mountain States, but only 87 percent in the Delta States. In the latter region, income, tenure, and related factors probably have more effect than in the other regions. But for all regions, the variables used explained an average of 95 percent of fertilizer use.

The figures in the first column of Table 1 indicate the percentage by which fertilizer consumption is predicted to decline for each one percent increase in the fertilizer/crop-price ratio, caused by either an increase in fertilizer price or a decline in crop price. For example, in the Southeast a one percent increase in the fertilizer/crop-price ratio is predicted to result in 0.95 percent decline in fertilizer consumption. Conversely, a decrease of one percent in the fertilizer/crop-price ratio will result in an increase of 0.95 percent in fertilizer use in the Southeast region.

In general, the fertilizer/crop-price ratio is of much greater relative importance than time, and the knowledge increase, and other factors associated with time, for the "older" using regions. In the Southeast, the percentage figure is 0.95 for the price ratio and only 0.06 for time; with the latter figure expressing the percentage increase in fertilizer use associated with each one percent increase in time.

Similarly, in the Delta States a one percent change in the fertilizer/crop-price ratio is predicted to change fertilizer use in the opposite direction by 1.6 percent; a one percent change in time is predicted to result in an increase in fertilizer consumption by only 0.2 percent. (The figures in column 2 under "time" can be used to express annual increase in fertilizer use if multiplied by 3.3 for the period 1926 to 1956, or 4.1 for the period 1926 to 1956, with 1944-50 omitted.) These annual figures would indicate an increase in fertilizer use with price factors remaining constant. A decrease in crop prices, fertilizer prices remaining constant, would cause the time effect alone to be less.

Viewing the price ratio alone, the fertilizer/crop-price ratio has much greater relative importance in the newer and more commercialized farming regions. These figures are interpreted to mean that a given percentage increase in the fertilizer/crop-price ratio, because of a decline in crop prices or an increase in fertilizer price, would result in a much greater decline in fertilizer use in the Northern Plains, for example, as compared to the Appalachian States. Also, the analyses suggest that any decline in the price ratio, due to improved manufacturing processes and lower cost nutrients, would result in the greatest percentage increase in fertilizer use in such regions as the Great Plains, Lake, Mountain, and Pacific States. But the time factor in these regions (including the Corn Belt) and the knowledge and custom factors which it expresses, also had a greater im-

Table 1. Relative effect of time and the fertilizer/crop-price ratio on fertilizer demand, 1926-56 (omitting 1944-50).

Region	Fertilizer/crop price ratio	Time	Percentage of "variance" in fertilizer use explained by predicting equations
Northeast*	—0.51	0.28	96
Corn Belt*	—0.68	1.28	98
Lake States	—2.60	0.60	98
Appalachian States	—1.01	0.11	92
Southeast*	—0.95	0.06	92
Delta States	—1.60	0.20	87
Southern Plains	—2.37	0.32	94
Northern Plains	—4.38	0.67	98
Mountain States	—2.51	1.20	99
Pacific States	—2.42	0.92	98

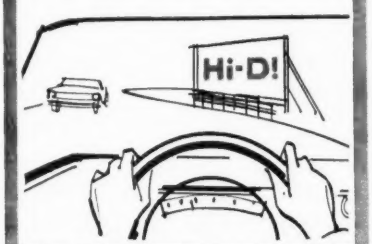
* These regions covered the whole period 1926 to 1956.

THERE ARE 6 SOUND WAYS TO SELL IN '60

AND THE Hi-D® PROGRAM'S GOT THEM ALL!

OUTDOOR

Billboards in 879 locations spread across 13 top-market states in the South and Midwest.

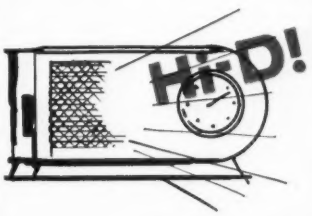


TELEVISION

A 10-state campaign for a solid 13 weeks emanating from 18 TV stations.

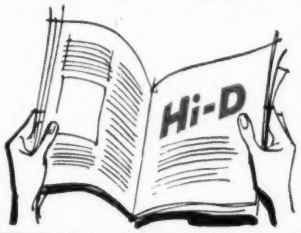
RADIO

A 13-week advertising program that saturates 17 states from 75 radio stations.



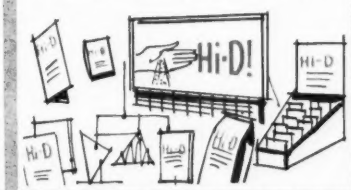
MAGAZINES

Full-page, four-color advertisements appear in "Progressive Farmer" . . "Farm Journal" . . . "Successful Farming" . . . and "Farm & Ranch."



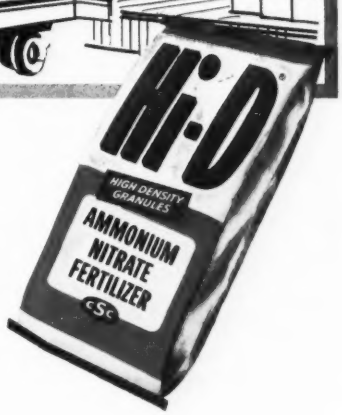
INSIDE THE STORE

Attention-getting point-of-sale material for in-store promotion. Includes Hi-D mobile . . . soil sample bags . . . counter display with Hi-D samples . . . wall banners . . . consumer folders . . . matches . . . and technical data service.



OUTSIDE THE STORE

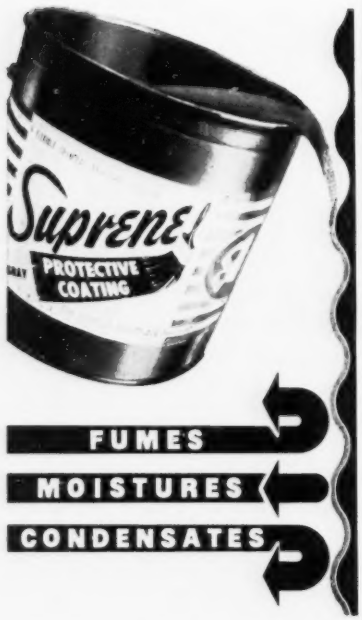
Two brand-new items designed for posting outside your store or warehouse: attractive Hi-D metal sign and large clock-style thermometer identify your store as Hi-D headquarters.



Hi-D keeps your sales on the grow in '60!

CSC

COMMERCIAL SOLVENTS CORPORATION Offices in Atlanta, Chicago, Cincinnati, Cleveland, Detroit, Kansas City, New Orleans, New York, St. Louis, Sterlington, La.



Extended Life Insurance

For Fertilizer Plants

And Equipment . . .

Suprene Chemical Resistant Coating has been especially developed for service under severe acid or alkali fumes, moisture vapors and condensates normally found in agricultural and industrial chemical plants. It may be applied to steel, concrete, wood or fabric using brush, roller or dip methods and will air dry in a period of from ½ hour to 2 hours depending upon conditions present at time of application. This coating has unusual adhesion qualities and a flexible tough surface which is highly resistant to corrosion and abrasion.

THE A. J. SACKETT AND SONS COMPANY
SACKETT EQUIPMENT
BALTIMORE · MARYLAND

1727 S. HIGHLAND AVE.

portance than in the older-fertilizer using regions.

It is thought that these differences exist between the "older" and "newer" using regions because of the differences in the capital and tenure situations, especially in the Southeast. Here, farmers have not had the capital necessary to purchase fertilizer in amounts that would enable its added cost to approach its added returns. Therefore, farmers buy fertilizer to the extent of their available funds. Another consideration is that true commercial farming is not on the same scale as in other regions, nor represented by as great a proportion of operators. In the Northeast, fertilization to obtain home-grown feeds, especially forage, has been important for milk production, causing fertilizer decisions to rest less on the fertilizer/crop-price ratio. In these several regions, response to fertilizer has been common knowledge over a much longer time than in the newer using regions.

In the short run demand analyses, the level of cash farm income was found to be most important in the newer fertilizer using regions. For example, a one percent change in cash—farm income was predicted to change fertilizer use by 0.76 percent in the Pacific, 1.22 percent in the Northern Plains, 1.27 percent in the Southern Plains, 1.08 percent in the Corn Belt, and 1.07 percent in the Lake States. The corresponding figures were only 0.34 percent for the Northeast, 0.24 percent for the Southeast, and 0.46 percent for the Appalachian region. The greater historic knowledge of fertilizer response in the older fertilizer using regions is largely responsible for this difference.

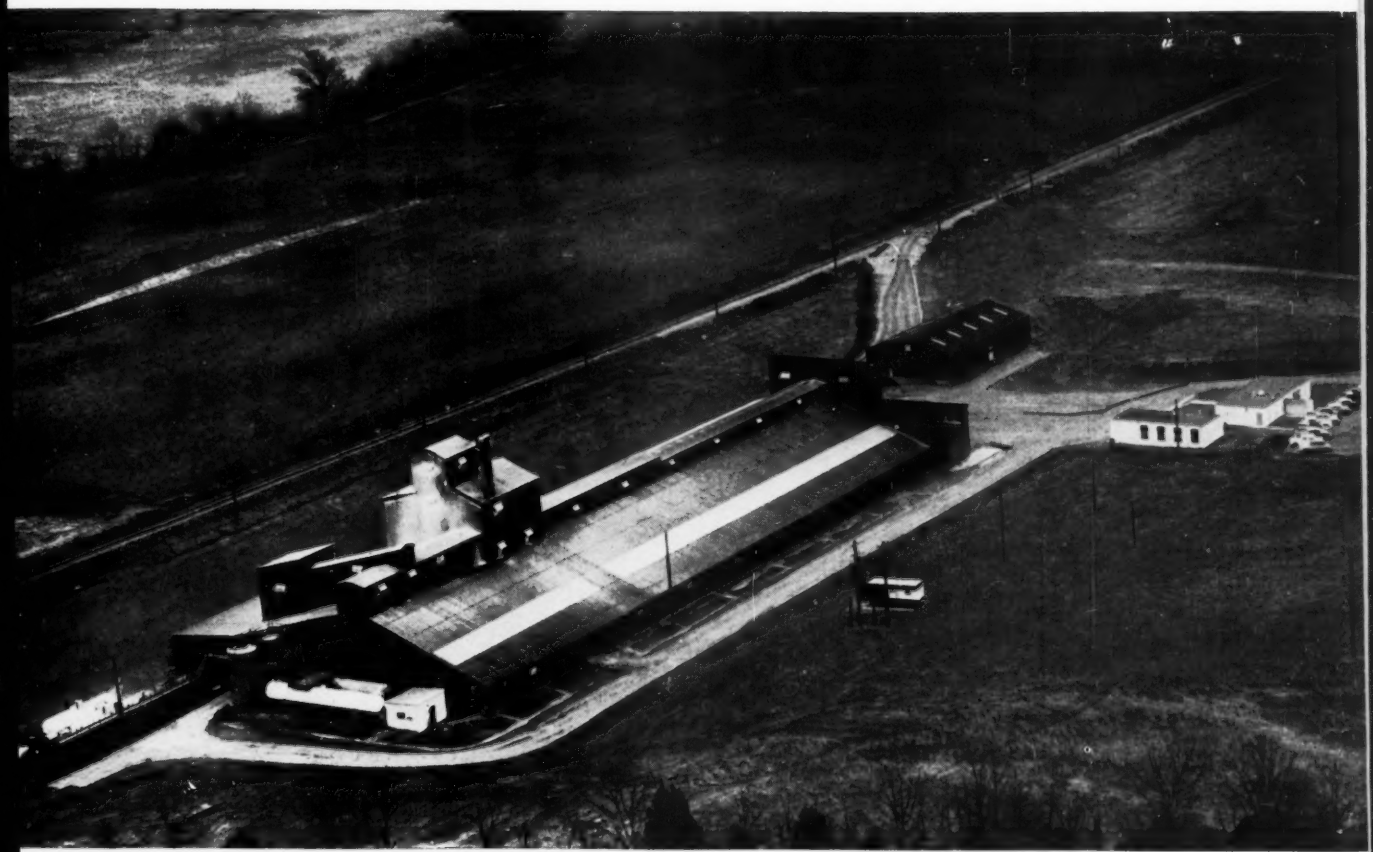
Other Factors Related to Fertilizer Use

In this summary, the relative importance of some of the factors affecting fertilizer use was explained. Although the results of this study do not give unquestionable measurements of each of the factors relating to fertilizer demand, it has established some general guidelines which may be used in guiding fertilizer educational programs during the coming period of rapid change. Perhaps the most important finding has been that there is no one factor which is a so-called "controlling" factor in the use of fertilizers by farmers. Many factors enter into the farmer's decision. These factors vary from area to area. Thus, the emphasis placed on each phase of fertilizer educational programs should vary from one region to another and should be based upon the needs of each individual region.

In the meantime, certain other factors important in determining quantity of fertilizer use by the individual farmers are being explored. Since farmers, in general, are limited on capital, the amount of fertilizer which is most profitable depends on the prices of the fertilizer materials used for different enterprises and the prices received for their products. For example, a farmer with limited funds will make more money by shifting capital from fertilizer to hogs if the price of hogs increases at the same time that the price of fertilizer increases. If both of these prices decrease, profits will be increased by shifting funds from hogs to fertilizer. It is important to determine how large these relative price changes must be to have material effect on fertilizer use.

The data used in this study suggest trends which might be expected in fertilizer use over the next decade, in response to greater education and knowledge and to such economic factors as fertilizer price as compared to crop prices. While further knowledge can add somewhat over the next decade to use of fertilizer on conventional crops, the magnitude of fertilizer consumption will depend more on what happens to fertilizer and crop prices relative to each other. On the basis of farmers' past response to price, each one percent increase in the fertilizer/crop-price ratio, caused by an increase in fertilizer price relative to crop price, is predicted to result in a decline in fertilizer use by nearly 1.25 percent. If new manufacturing processes and materials result in a decline in fertilizer prices relative to crop prices by one percent, demand would increase by this greater percentage.

And these price variables or factors will be relatively great in the future as compared to knowledge and the general increase in use due to time, because of the period we have just been through in acquainting the farmers with fertilizer technology. Knowledge and time, as factors, will certainly be less important than price factors in the next decade—much more so than in the past decade—in causing changes between years in total fertilizer consumption by American farmers. Or, stated another way, the effort to increase future fertilizer use through education and knowledge will have to be much greater than in the past two decades to attain the same percentage increase in fertilizer use.



A NEW PLANT FOR KENTUCKY . . . A NEW RECORD FOR SACKETT

Here's a brand new granular plant for Kentucky . . . and a remarkable new construction record for The Sackett Company.

Recently completed at Russellville for Cooperative Fertilizer Service of Richmond, this big and fully automated fertilizer manufacturing facility* was built by us in 6 short months.

This is the kind of field performance that Boards of Directors and top management people are looking for . . . the kind they are finding in Sackett . . . *and at the right price, too!*

*Including offices, service buildings and rail sidings

THE A. J. SACKETT AND SONS COMPANY
SACKETT EQUIPMENT
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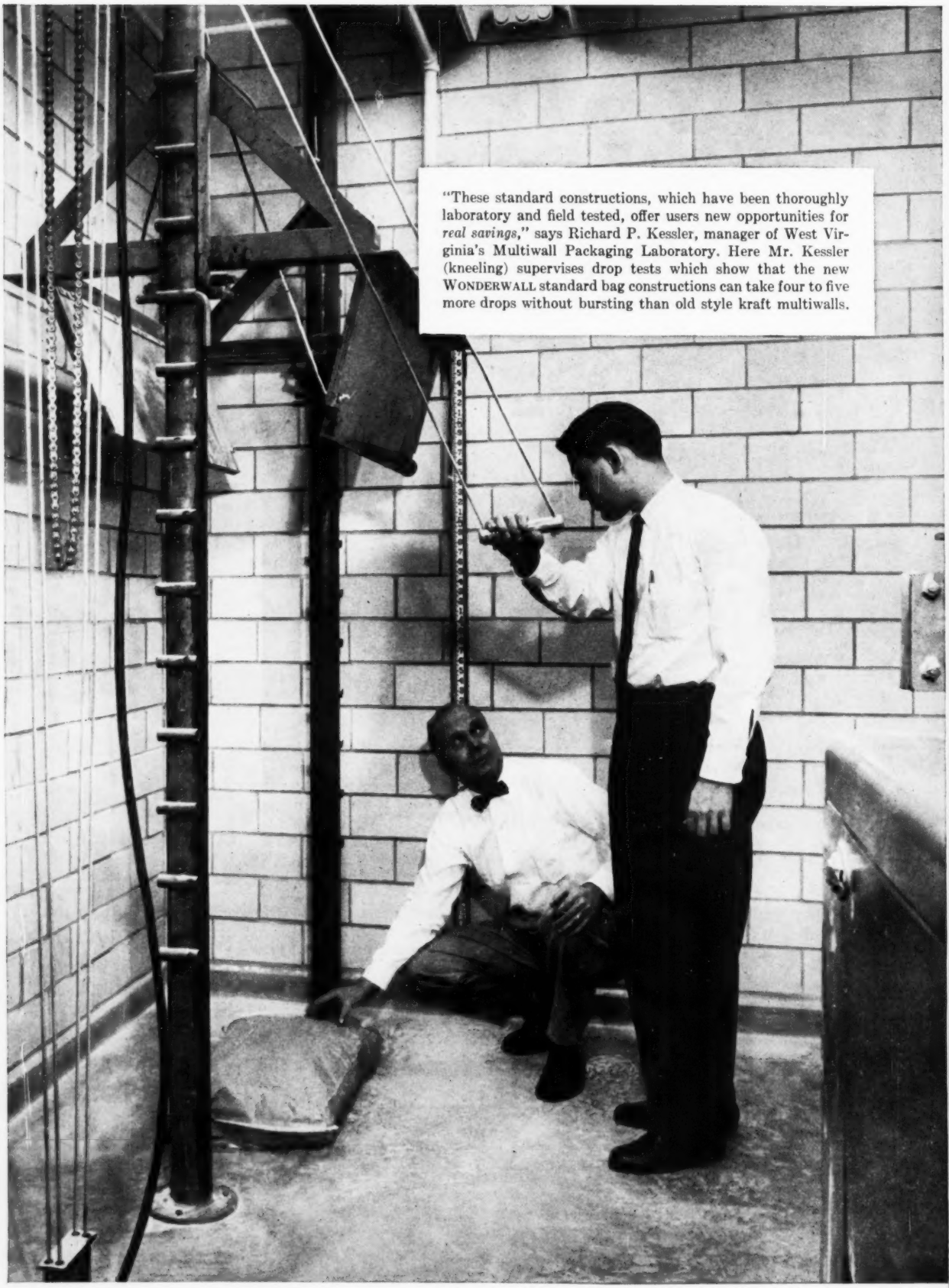
1727 S. HIGHLAND AVE.

America's Foremost Creative Designers and Builders . . .

- COMMERCIAL FERTILIZER PLANTS
- SUPERPHOSPHATE PLANTS
- RELATED PRODUCTION EQUIPMENT

SEE SACKETT PRODUCTS IN CHEMICAL ENGINEERING CATALOG



"These standard constructions, which have been thoroughly laboratory and field tested, offer users new opportunities for *real savings*," says Richard P. Kessler, manager of West Virginia's Multiwall Packaging Laboratory. Here Mr. Kessler (kneeling) supervises drop tests which show that the new WONDERWALL standard bag constructions can take four to five more drops without bursting than old style kraft multiwalls.

NEW!

WEST VIRGINIA'S 1960 STANDARD BAG CONSTRUCTIONS TO SAVE YOU MONEY

Major savings for fertilizer packers are being achieved by three new standard WONDERWALL bag constructions perfected by West Virginia.

During a controlled test to determine possible savings in bag costs, various WONDERWALL constructions were developed in our Multiwall Packaging Laboratory. They were tested by 101 packers who shipped 569,224 tons of fertilizer in 12,307,546 WONDERWALLS.

The three recommended standard constructions and their actual savings, as used in normal conditions, are shown in the box.

For example, where a typical 100# old fashioned kraft bag usually would require 1/90 AL, 2/40, 1/50 for a total of *four* plies, the new standard WONDERWALL provides the same or superior strength with *three* plies: 1/100 AL, 1/40, 1/50 . . . at a saving of $3.50 per M.

Secret of WONDERWALL's strength is Kraftsman Clupak*, the paper with the built-in stretch that withstands far more impact without breaking than conventional natural kraft multiwalls. In a WONDERWALL bag, fewer plies are needed to do the job!

See how WONDERWALL standard bag constructions can *cut your costs, increase your profits.* Our technical service experts are ready to help you take full advantage of these new bag developments; call or write Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Ave., New York 17, N.Y.

**Clupak, Inc.'s trademark for extensible paper manufactured under its authority.*

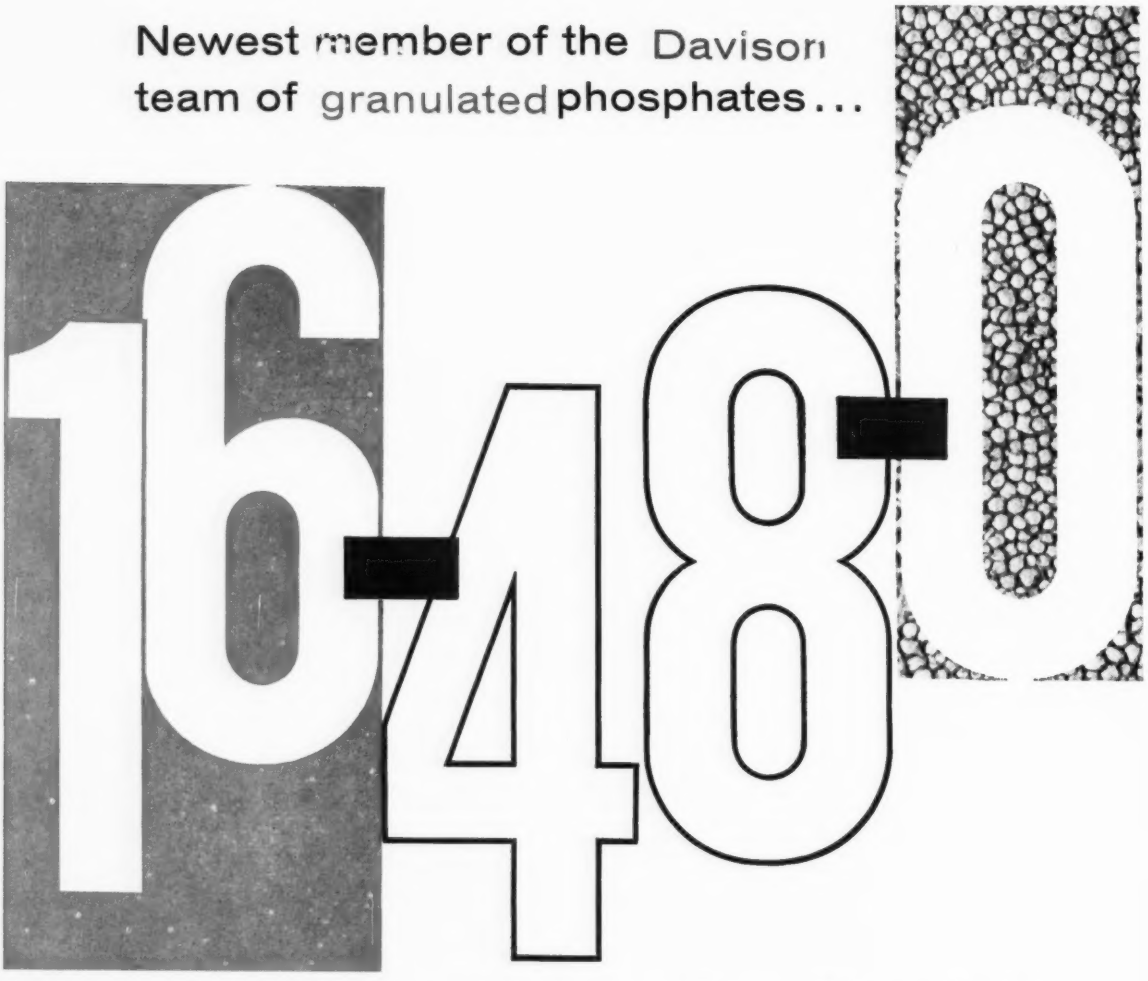
NEW STANDARD WONDERWALL FERTILIZER BAG CONSTRUCTIONS

Pounds Packed	Old Style Natural Kraft Construction	New Wonderwall	Actual User Savings
100#	1/90AL, 2/40, 1/50	1/100AL, 1/40, 1/50	$3.50/M
80#	1/90AL, 2/40, 1/50	1/100AL, 1/40, 1/50	$3.10/M
50#	1/90AL, 1/40, 1/50	1/100AL, 1/60	$3.80/M

Smith-Douglass Co., Inc., Norfolk, Va., has shipped over 50,000 tons of fertilizer and related products in a million new WONDERWALL 100# standard construction bags. They report excellent results with a saving of $3.50 per M and reduced bag breakage.

West Virginia Pulp and Paper

Newest member of the Davison team of granulated phosphates...



DAVISON Diammonium Phosphate

MAKES HIGHER ANALYSIS MIXTURES . . . than ever before—and makes them more easily. 48 guaranteed units of P_2O_5 PLUS 16 units of highly soluble NITROGEN.

FOR DIRECT APPLICATION . . . an exact 1-3-0 ratio—ready to use and sell . . . beautifully granulated.

FOR DRY MIXING . . . new ratio simplifies figuring formulas. You buy on "per ton" basis rather than paying "per unit" basis.

READY FOR SHIPMENT . . . right now. Make this profitable new phosphate part of your operation. Call Davison in Baltimore today at SAratoga 7-3900.

W. R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

Some formulations of ratios in higher analysis grades using DAVISON 16-48-0.

Ratio Analysis	Pounds of Material Required			
	16-48-0	*21% Sul. Ammo.	46% Triple	60% Mur. Pot.
1-1-1 14.4-14.4-14.4	602	917		481
1-2-2 11-22-22	917	349		734
1-4-2 8.5-34-17	1063		370	567
1-4-4 6.6-26.5-26.5	828		290	882

**Other higher analysis nitrogen materials (urea and ammonium nitrate) may be substituted in above formulations.*
Analysis in the more popular ratios, such as 12-12-12, 10-20-20, 6-24-12, 5-20-20, can be manufactured by the addition of granular dolomitic limestone or other materials.

Major 1959 Accomplishments Reported to Safety Board

A fertilizer industry Safety Handbook, and a Supervisory Safety Training Project, were two of the outstanding accomplishments scheduled this year for the Fertilizer Section, National Safety Council as decided by their executive committee at a meeting held February 4, in the new Florida Hotel, Lakeland. Elmer Perrine, of Allied Chemical Corp., chairman of the Section presented the two projects which were immediately discussed and plans made for their successful completion.

The fertilizer industry handbook is to cover all safety measures needed in a fertilizer plant. The construction of the Handbook is being engineered by John E. Smith, Safety Director of Spencer Chemical Company.

The Supervisor Training Project was well covered by W. C. Creel, chairman, who reported as follows to the Executive Committee:

"For the second straight year, a Supervisory Safety Training Project was conducted by the Fertilizer Section of the National Safety Council. The program was sponsored and underwritten financially by the National Plant Food Institute.

"Regional meetings were held in Ithaca, New York, for the Northeastern states; in Chicago, Illinois, for the Midwestern states; in Atlanta, Georgia for the Southeastern states; in Fresno, California, for the Far West states; and in Houston, Texas, for the Southwestern states.

"A total of 95 men from 68 fertilizer plants in 25 states and Canada were registered students in the five schools. The big majority of those attending were superintendents and foremen. In addition, there were plant safety directors, division managers, a manager of industrial relations, and area supervisors. Seven members of the executive committee of the Fertilizer Section, NSC, served as regional directors, program participants, or otherwise took active part in the meetings.

"W. C. Creel, safety director of the North Carolina Department of Labor, and chairman of the Fertilizer Section's Supervisory Training Committee with the advice and assistance of Paul Truitt, now president of the National Plant Food Institute, served as national chairman of the project. Regional directors were Stratton McCargo, safety director of G.L.F. Soil Building Service for the Northeast; John Smith, safety director of Spencer Chemical Company for the Midwest; Quentin Lee, director of Plant Food Production, Cotton Producers Association for the Southeast; Orm Chinnock, technical representative, Nitrogen Products, Hercules Powder Company for the Far West; and Ansel Raney, safety director for the Phillips Chemical Company for the Southwest. Regional directors of the National Plant Food were in charge of arrangements and finances for the meetings. These N.P.F.I. representatives were Dr. Z. H. Beers and George Barclay, Chicago; Dr. S. A. Tisdale, Atlanta; Dr. R. B. Bahme, San Francisco; and Dr. R. L. Beacher, Fayetteville, Arkansas.

"The agenda for the five schools offered a good balance between safety training subjects and supervisory training techniques. Outstanding industry safety leaders and well-known professors in college safety work, as well as technical authorities from commercial companies and government officials in the safety field, acted as instructors for the schools. Most of the well known types of visual aids, featuring National Safety Council materials, were used throughout the meetings. A highlight of each meeting was student participation sessions where questions and answers to practical problems in the fertilizer industry were presented by the students."

"Who Gets Hurt" New Safety Folder

"Who gets hurt in industrial accidents?" is a question asked—and answered—by a new pamphlet published by the National Safety Council.

The pamphlet — entitled, "Who Gets Hurt?"—uses a humorous approach, multicolored cartoons and concise text to discuss on-the-job injuries. It says the man who gets hurt is the man who thinks he's invulnerable.

The 16-page pamphlet explains the type of worker most likely to be accident-prone, how workers and their families are hurt in accidents, where accidents happen, what injuries cost the worker and his family, and what you can do about accidents.

A single copy of "Who Gets Hurt?" may be obtained free from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

FERTILIZER SAFETY COMMITTEE MEMBERS

BACK ROW—1. E. O. Burroughs, Jr., F. S. Royster Guano Co.; 2. Mike Ellison, Mississippi Chemical Co.; 3. A. B. Pettit, W. R. Grace and Company; 4. James Phillips (Visitor) Davison Chemical Co., Div. of W R. Grace & Co.; 5. George Dietz, Fertilizer Manufacturing Cooperative; 6. W. A. Stone, Wilson and Toomer Fertilizer Co.; 7. Frank Gerard, Olin-Mathieson Chemical Corp.; 8. Paul Truitt, National Plant Food Institute; 9. Stratton McCargo, G.L.F. Soil Building Service; 10. M. A. Petersen, National Safety Council.

MIDDLE ROW—1. Carl Alkire, Davison Chemical Div., W. R. Grace & Co.; 2. Dr. E. J. Largent, Reynolds Metals Co.; 3. D. W. Flagler, Davison Chem. Co., Div. of W. R. Grace Co.; 4. C. S. Griffith, Virginia-Carolina Chemical Co.; 5. Emerson Jones, Nitrogen Div., Allied Chemical Corp.; 6. Grayson Morris, Southern States Cooperative; 7. John E. Smith, Spencer Chemical Co.; 8. W. C. Creel, North Carolina Dept. of Labor.

SITTING—1. Gaither Newnam, Smith-Douglass Company; 2. Ansel Raney, Phillips Chemical Co.; 3. Elmer Perrine, Nitrogen Div., Allied Chemical Corp.

CALIFORNIA

Valley Nitrogen's new $10,000,000 plant was dedicated early last month. Ignoring rain, a thousand farmers turned out for the occasion. The plant, already in operation was turning out its 150 daily tons of anhydrous ammonia, 200 tons each of ammonium sulphate and ammonium phosphate. 1560 farmers invested an average of $3500 each to finance the operation what was termed "a natural" which would not have made sense 10 or 20 years ago, but was ideally located for today's conditions in the Valley. As our readers know who have followed construction of this new facility, it is located near Helm.

FLORIDA

Davison Chemical is now in operation with its triple superphosphate plant at Bartow. An additional sulphuric acid plant there will help serve the new production set-up. At the same time, the added production has required a new warehouse and Davison is also modernizing the phosphate rock washing plant at its Florida mines.

* * *

Florida Nitrogen Co., a wholly owned subsidiary of Southern Nitrogen held open house early last month for its new $2,000,000 plant in Tampa. This plant, now in production on calcium ammonium nitrate and a full line of N solutions, has in addition a nitric acid unit under construction which will be in operation shortly. George Taylor is president; resident are vice-president R. G. Riley and plant manager N. F. Maddux.

* * *

Tennessee Corporation's U. S. Phosphoric Products division will build a new multi-million dollar plant at East Tampa which will supply ammonia to Southern Nitrogen, which has contracted for 30% of production over a period of years, to supply its subsidiary, Florida Nitrogen Co. at Tampa. Tennessee Corp. will process much of the remaining ammonia into diammonium phosphate at their East Tampa plant completed last year.

GEORGIA

Southern Nitrogen, whose plant at Savannah went into production in 1957, is now embarking on a multi-million dollar expansion there. The company produces ammonia, nitric acid, and ammonium nitrate solutions, at Savannah and Tampa principally for conversion into fertilizers. John R. Riley is president.

Current expansion includes the construction of facilities to produce 20.5 per cent solid ammonium nitrate-limestone and solid urea. Two large warehouses also are being built.

Slated for expansion are the nitric acid, ammonium nitrate solution and liquid urea departments, according to George V. Taylor, vice-president, sales, who said it was undecided when the work will begin but that it should be completed by the end of 1961. He said the cost will be "several million dollars."

IDAHO

Bunker Hill tells us that they expect to go into first production about July 1 with their new phosphoric acid plant at Kellogg, which is going up on schedule.

* * *

J. R. Simplot Company is constructing new storage facilities at their phosphate plant near Pocatello, as part of a $2 million expansion program started last summer. Company officials expect a production increase of 50% this year.

IOWA

American Agricultural Chemical has announced the purchase of a tract of land north of Belle Plaine, but has made no announcement as to the use to which it will be put.

* * *

Ke-Wash Fertilizer has purchased the C & NW railroad roundhouse at Keota for use as a warehouse to supplement their plant there.

KANSAS

Cooperative Farm Chemicals Assn. is adding again to its plant at Lawrence, which is already rated as one of the largest in the N field. 75% owned by Consumers Cooperative, the plant opened up in 1954; not many weeks ago it completed a $5,500,000 addition, and has just announced another $3,000,000 expansion. Both of these were awarded to Chemical Construction. The new unit will add 100 daily tons to the ammonia production and will include an addition to the urea facilities. Central Farmers Fertilizer is a minority stockholder.

MICHIGAN

Smith Bros. Elevator of Lake Odessa are building at Woodbury a fertilizer mixing plant on the site of the elevator which burned down ten years ago. They will do custom mixing as well as supplying standard grades; will make a feature of using trace elements; will offer bulk or bagged goods at their operations in Woodbury, Woodland and Lake Odessa. Larry Smith is president.

MISSISSIPPI

Mississippi Federated Cooperative has completed installation of ele-

Aerial view of the new $2 million Florida Nitrogen plant at Tampa.

vated tanks at the Canton fertilizer plant. Liquid fertilizer manufacturing facilities, already installed in the Meridian plant, are now being added to the Canton facilities. Formulation will be in five-ton batches for immediate delivery.

The warehouse at Corinth, destroyed by fire in October, is being repaired and renovated and will soon be in operation.

OHIO

Green Camp Plant Food Co. has been established in Marion as a distributing facility for Diamond Fertilizer of Sandusky. It will be operated by Clifford Smith.

* * *

Solar Nitrogen Chemicals has undertaken a two million dollar expansion of the ammonia, urea, nitric acid, and nitrate facilities at its Lima plant, it was announced today by Edward F. Morrill, president.

This expansion, resulting in an annual increase in ammonia production of some 25,000 tons per year, is moving ahead rapidly and completion is anticipated during 1960.

The company's products are sold by **Sohio Chemical Company,** manufacturing and sales agent for Solar Nitrogen Chemicals, Inc., which is jointly owned by Atlas Powder Company and Standard Oil Company (Ohio).

OKLAHOMA

O. K. Fertilizer Co., Guymon, has been chartered with $20,000 capital stock and a 50-year duration by Nathan S. Jarnigan, Jr., Doris M. Schidler and G. H. Garrett.

OREGON

Gro-Mor Fertilizer Co. is the name to be used by Floyd Claypool and William G. Spady who have bought the Oregon Soil Clinic business at Salem from E. H. Bixby. New lines of crop chemicals will be added, according to Mr. Claypool, who will move to Salem from Portland to operate the business.

* * *

Albert Dickinson Co. has leased a site at Aumsville for a bulk fertilizer distributing plant which will be able to warehouse six carloads. This is on the site of an abandoned depot in the Shaw community. Mr. Dickinson is building a similar operation near Lebanon. The operations will funnel fertilizer into boxes which can be loaded onto farmers flat bed trucks.

PENNSYLVANIA

HOFFMAN GOODS IN NEW BAGS

A. H. Hoffman, Inc., Landisville, has started off the "Selling 60's" with a completely redesigned line of paper bags for their organic plant foods. Designed and produced by the flexible packaging division, Continental Can Company, the new sift-proof packages maintain the identity of the old packages while adding eye-catching decoration to the line.

The Hoffman line, all of which will be packaged in the new designs this year, includes: Rose food, Azalea food, Cow manure, Sheep manure and Bone Meal.

TEXAS

Olin-Mathieson has launched at Houston a $1,000,000 expansion program which is said locally to create the world's largest fertilizer plant. It will expand present facilities at their Ship Channel plant 50%, and will produce di-ammonium phosphate. The present plant makes its own sulphuric acid, and takes ammonium sulphate from the nearby Phillips Chemical operation. Kaiser Gypsum has acquired a site adjacent to the O-M operation, which will be the base for a $5,000,000 plant.

* * *

Commerce sources at Hondo report that a fertilizer plant has leased five acres in the western section of Hondo and soon will begin construction of a building.

WISCONSIN

Kickapoo Fertilizers, Stevens Point, has bought controlling itnerest in **N. S. Koos & Son,** Kenosha, one of the largest fertilizer plants in the state. Bayard Baldridge, executive vice president and general manager for Kickapoo, holds the same office in the Kenosha operation, and says the new management will continue with the Koos brand name and distribution channels.

Phillip Q. Sawin of Madison is now president and Raymond A. Russell of Wisconsin Rapids is secretary of the Kenosha firm; both men hold the same offices in the Kickapoo organization.

A minority interest in the Kenosha operation is still held by the former Koos stockholders.

CANADA

International Minerals & Chemical Corp. (Canada) Ltd. will introduce into this hemisphere the process known and long used in Europe known as "tubbing" in the operation of its Saskatchewan potash mine, now under construction. This process is a vertical application of the cast iron tunnelling commonly used in vehicular tunnels under rivers and lakes. It is being adopted for safety and for long-range efficiency.

The $750,000 job will be handled by the German firm of Haniel & Luge, mining engineers. The lining will weigh 3,000 tons and will be applied in the 300-foot section between the 1200 and 1500 foot levels to wall off water-bearing Blairmore sands.

The shaft is now down to the 1200 foot level.

INDIA

The urea plant to be built 140 miles from Madras in Southern India, and which is to have an output of 500 daily tons is state owned. It is said it will be the largest of its kind in the world.

INDONESIA

Sriwidjaja Fertilizers, government owned, has been loaned $33,200,000 by the Export-Import Bank to build a fertilizer plant at Palemburg, Sumatra — using the abundant natural gas in the area. This will be supplied by Standard Vacuum Petroleum and urea will be produced by the Pechiney-Grace process. Foster Wheeler has been given the design and construction contract. The total cost of the plant is to be $43,200,000.

JORDAN

Arab Potash Co. is now planning to invite bids for the construction of a full-scale potash plant producing 70,000 annual tons from the brines of the Dead Sea. This will be done based on performance of the pilot plant, put into production last November, for a full year.

MEXICO

Texas Gulf Sulphur Company, world's leading producer of sulphur, announced Feb. 16 the suspension of operations at its sulphur plant at Nopalapa, in the State of Vera Cruz.

The decision is a simple matter of economy, according to the company. The Nopalapa plant is a small producer and its cost of operation is high relative to the company's other more efficient producing units.

Since production began in 1957, Nopalapa's output has averaged

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Southwest Potash Corp.

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about 100,000 tons of sulphur annually, less than four per cent of the company's total average annual sulphur production.

MOROCCO

Sutrima will build a 200,000 annual ton superphospate plant at the port of Safi, and is planning additional plants to produce sulphuric and phosphoric acids. The basic plant is to cost $13,000,000. Sutrima is a joint venture of the Moroccan Government and a number of European phosphate buyers. The phosphate rock will come from Louis Gentil by rail.

PERU

Montecatini has pointed out that the Fertilizantes Sinteticos plant at Callao which has been in production since September, is not only Montecatini sponsored, but engineered as well. This corrects two errors in our January item. The plant is the first synthetic fertilizer plant to go on stream in South America, and has been so successful that production capacities may soon be revised upward. The plant is a $12,800,000 operation.

SOUTH AFRICA

African Explosives and Chemical Industries is expecting to start production by June in their $28,000,000 nitrogen plant in the Transvaal. Expected to have a capacity of 110,000 annual tons, it will supply enough additional N to make South Africa independent of imports of this fertilizer ingredient.

Davison's New Granular Diammonium Phosphate

Introduction of granulated diammonium phosphate as an addition to the Davison line of agricultural chemicals is announced by W. R. Grace & Co. Davison Chemical Division. The formula is 16-48-0.

The exact 1-3-0 ratio, the company points out, simplifies mixing formulas, while contributing to the high analysis character of the mixed product. Granulation also simplifies mixing and provides better application qualities.

Diammonium phosphate continues to gain as a source of high analysis fertilizer. The Davison product may be used either for direct application —usually in areas where potash is not needed in the soil—or for blending into complete fertilizers. It is water and citric soluble.

The company will use the product in its own mixing operations, and sell it to other fertilizer processors and mixers, and for direct application.

CHANGES

IMC's New Technical Service

International Minerals & Chemical Corporation has completed organization of a new Technical Service Department which the company says will give customer companies unique "full line" service in every phase of fertilizer manufacturing.

Causey

Five technical service representatives have been added, each with an extensive industry background. They will work with customers on the full range of nitrogen - phosphate - potash problems, from plant blueprints through to actual production.

DeLong

Franklin

Heck

Johnson

IMC officials describe the department as a further concrete example of the Full Orbit customer service philosophy of the company's Agricultural Chemicals division. It follows up sales training and marketing clinics, a transportation counseling service, and counseling in such other areas as credit and insurance.

"The quality of the personnel, the scope of the program, and the resources behind the five-man team makes IMC technical service an invaluable aid to customers in keeping their plants operating for peak profits," said Leonard W. Gopp, division vice president.

Technical service personnel will operate from the five regional offices of the Agricultural Chemicals Division.

Robert R. Heck, former director of Technical Service for Southern Nitrogen Company and before that a research chemist and technical sales representative for Allied Chemical Corporation, is assigned to the Shreveport region. Charles E. Franklin, who was manager of Technical Service for the Fertilizer division of Phillips Petroleum Company, is assigned to Indianapolis. William W. Johnson, former technical service representative for Mississippi River Chemical Company and more recently with Armour Chemical Company, is located in New York.

James M. DeLong, assigned to the Minneapolis region, has been with IMC since 1952, first in research, then as a chemical development engineer at Carlsbad, New Mexico. H. E. Causey who will be in the Atlanta region, rejoined IMC in 1957 as technical service representative in the former Potash Division. He had been with the company from 1939 to 1948, and most recently had been manager of the Tuscola plant of Illinois Farm Supply..

According to Richard E. Powell, manager of the Technical Service Department, the department plan of action covers both emergency help as well as current and future needs.

Stepan Buys Ris-Van In Iowa

Expansion into the liquid fertilizer business through acquisition of Ris-Van, Inc. of Belmond, Iowa, was announced recently by Alfred C. Stepan, Jr., president of Stepan Chemical Company of Chicago.

Ris-Van, Inc. was purchased by Stepan through an exchange of stock. Sales of Ris-Van amounted to $2,300,000 last year, and are expected to rise to about $3,500,000 this year.

"We consider liquid fertilizer the fastest growing part of that industry," Mr. Stepan said in announcing the purchase. He stated the action marks a continuation of Stepan's expansion and diversification program, which previously resulted in the acquisition of Ninol Laboratories, Inc., and Maywood Chemical Works.

Ris-Van will be operated as a wholly owned subsidiary under present management. Kenneth Van Duzer continues as president.

Hercules Buys Nitroform Assets

Hercules Powder Company announced Feb. 15 it had purchased the assets of the Nitroform Agricultural Chemical Company of Woonsocket, Rhode Island, producer of urea-formaldehyde fertilizer compounds.

Production of urea-formaldehyde compounds under the trade name of Hercules-Nitroform Blue Chip, a granular free-flowing fertilizer, and Hercules-Nitroform Powder Blue, a wettable powder designed for liquid application, will continue at Woonsocket, Rhode Island, with additional facilities at Hercules, California, expected to be on stream by July of this year.

Southwest Potash Moves New York Office

Southwest Potash Corporation has moved its New York offices to Rockefeller Center in midtown Manhattan. The new address is 1270 Avenue of the Americas, New York 20, N. Y., telephone PLaza 7-9590, TWX: NY 1-870.

Their other offices will remain the same—Atlanta 3, Ga.: 902 Healey Building, phone JAckson 3-2541; Des Moines 10, Iowa: 5731 Urbandale Ave., phone BLackburn 5-1135.

Niagara Chemical Organizes Western Agricultural Dept.

A major reorganization of its Western operations has been instituted by Niagara Chemical division of Food Machinery and Chemical Corporation. This was indicated by Stuart H. Bear, the division's manager, in announcing formation of the Western Agricultural department. The move was necessitated by expansion of Niagara's West Coast activities through the purchase in early 1959 of Sunland Industries, Inc.

Until now, Niagara has produced its full line of products for West Coast consumption in Richmond and Yakima. Now, the Fresno plant, formerly operated by Sunland, will bring expanded production of some pesticides plus initial entry into seed and fertilizer production for the company as a whole.

The Western Agricultural Department will serve eleven states in all. These are: California; Oregon; Washington; Montana; Utah; Nevada; Colorado; Wyoming; Arizona; Idaho; New Mexico.

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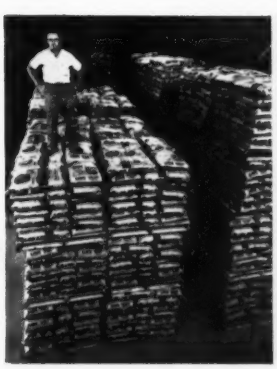

Monsanto

ASSOCIATION ACTIVITIES

Two NPFI Task-force Reports

National Plant Food Institute has sent its voting representatives copies of two reports from the forest research "task force."

Of interest to participants in forest fertilization data, the clearing house program has issued a series of model summaries from those who have already participated, as an example to be followed by those who have not.

Forest Research in the South, the second document, is 50-pages, including a review of literature on the subject, a classified listing of research projects now under way, suggestions for making field forest fertilization tests, and other subjects germane to the whole field of forest research.

Southern Control Meeting June 21-21

The Association of Southern Feed and Fertilizer Control Officials will hold its next annual meeting at Gatlinburg, Tennessee, June 21 and 22, 1960. The meeting is scheduled at the Riverside Hotel according to Maurice B. Rowe, Secretary-Treas.

ILLINOIS FERTILIZER CONFERENCE

Top: At the Illinois Fertilizer Conference in Champaign Feb. 4 industry representatives Werner L. Nelson, left, Midwest manager for American Potash Institute and Zenas H. Beers, Midwest regional director for National Plant Food Institute, discussed things with M. B. Russell, right, head of the Department of Agronomy, University of Illinois.

Bottom: Officers of the Illinois Fertilizer Industry Association shown here: H. L. Stangel, Darling and Co., East St. Louis, treasurer; J. R. Abbott, Ashkum Fertilizer Co., Ashkum, vice-chairman; R. B. Nethery, Federal Chemical Co., Danville, secretary; and R. A. Weis, Virginia-Carolina Chemical Corp., East St. Louis, chairman.

Mr. Weis shared the program with U. of I. staff members who reported on current fertilizer research at the University of Illinois.

More than 250 fertilizer representatives attended

Nelson Heads NPFI Midwest Advisory Group

Frank Nelson, Rath Packing Co., was named chairman of National Plant Food Institute's Midwest Industry Advisory Committee at a February meeting in Chicago. He succeeds Richard E. Bennett, Farm Fertilizers, Inc.

The following industry men were appointed to fill vacancies on the committee: John Ground, Davison Chemical Co., Division of W. R. Grace & Co.; M. W. Mawhinney, Smith-Douglass Co., Inc.; and W. B. Copeland, Olin Mathieson Chemical Corp.

Among actions taken by the committee were:

1—Approved NPFI cooperation in a soil fertility program in Des Moines County, Iowa, working with the county agent and the Iowa State University area agronomist.

2—Endorsed the activities of the Institute in promoting better fertilizer legislation in Illinois.

3—Appointed a committee to consider results of Fertilizer Promotion Workshops in the Midwest region and to prepare recommendations for the committee approval and presentation to the Institute's Board of Directors.

4—Reviewed reports and endorsed NPFI cooperation in intensified county soil fertility programs in Ohio, Michigan and Kentucky.

5—Approved NPFI activities in the Minnesota Pasture Fertilization program.

6—Approved Institute activity in promoting an educational program with bankers in South Dakota and Missouri and recommended the expansion of this program into other Midwestern states.

7—Set March 15, 1960, as the date for the next meeting of the Midwest Industry Advisory Committee.

California Conference Coming April 11-12

The Eighth Annual California Fertilizer Conference will be held on April 11 and 12, 1960, at Fresno, according to its sponsor, the Soil Improvement Committee of the California Fertilizer Association. 300 persons will attend including farmers; fertilizer management; salesmen and technicians; official workers of the University, the State Colleges, and the federal and State Departments of Agriculture; laboratory technicians; processors' field representatives.

The program is being developed around a theme of "Phosphate Fertilization", by a sub-committee under the direction of J. H. Nelson, Nelson Laboratories, and Earl R. Mog, Growers Fertilizer Company, both of Stockton.

Formal program is scheduled for the mornings of both days, in the auditorium of McLane Hall, Fresno State College. A field tour of fertilizer plots and demonstrations in the vicinity of the campus will be held. It is planned to have University of California and other institutional technicians, as well as those from the fertilizer industry present the latest information concerning fertilizer practices, with emphasis on phosphate fertilization.

The annual Banquet will be held at the Fresno Hacienda Hotel on the evening of Monday, April 11th. Earl Coke, Vice President, Bank of America, San Francisco, has been invited to be the featured speaker on the subject "A Banker Looks at Fertilization For Enhanced Loan Security".

Mississippi Council Sets August Meeting

The Mississippi Soil Fertility and Plant Food Council will hold its next meeting August 25-27 at the Buena Vista Hotel in Biloxi.

H. S. Gordon, Jr., of Jackson, was

Industry Meeting Calendar

DATE	EVENT	LOCATION	CITY
June 12-15	National Plant Food Institute	Greenbrier Hotel	White Sul. Spgs., W.Va
June 21-22	Southern Control Officials	Riverside Hotel	Gatlinburg, Tenn.
July 13-15	Pacific N. W. Fertilizer Conference	Hotel Utah	Salt Lake City
July 27-30	Southwest Fertilizer Conference	Galvez Hotel	Galveston, Texas
Sept. 29-30	Northeast Fertilizer Conference	Hotel Hershey	Hershey, Pa.
Oct. 5-6	Southeast Fertilizer Conference	Biltmore Hotel	Atlanta, Ga.
Oct. 17-18	Fertilizer Safety Section	LaSalle Hotel	Chicago, Ill.
Nov. 2-4	Fertilizer 'Round Table'	Mayflower Hotel	Washington, D. C.
Nov. 9-11	National Fertilizer Solutions Assn.	Peabody Hotel	Memphis, Tenn.
Nov. 13-15	California Fertilizer Association	del Coronado Hotel	Coronado, Calif.

named as the group's first president; Mike Blouin, Jr., of Columbus, vice president. W. L. Ashley of Jackson, secretary-treasurer. The advisory committee of the annual conference, of which Commissioner of Agriculture Si Corley is chairman, will serve as the board of directors. Other members of the committee will include J. T. Caldwell Jr., and Charlie McNeil of Jackson; M. G. Field of Hattiesburg; H. W. Latimer of Philadelphia; and J. E. Young of Tupelo.

NC Soil Science Meeting

Approximately 125 persons attended the third annual meeting of the Soil Science Society of North Carolina which was held in Raleigh on February 4 and 5.

Highlight of the meeting was an after dinner address by the honorable L. Y. Ballentine, Commissioner of Agriculture for North Carolina. Pointing out some of the reasons for today's misconceptions about agriculture, Mr. Ballentine stressed the need for an association of organizations at the state, regional, and national levels with the sole responsibility of telling the American public the true story of agriculture, its achievements, problems, and importance. American farmers —the world's most efficient producers for humanity's most basic material needs—are 'without honor in their own country,' he said.

Western Cotton Conference

The 1960 Western Cotton Production Conference held, March 1-2, was expected to draw cotton growers from five southwestern states. Held at the Hacienda Motel, the program was keyed to problems of growers in the Western irrigated area.

The conference was sponsored by the Southwest Five-State Cotton Growers Association and the National Cotton Council, in cooperation with Land-Grant colleges, agricultural chemicals industry, U. S. Department of Agriculture, and other groups.

CFA Dates November 13-15

The 37th Annual Convention of the California Fertilizer Association will be held at the Hotel del Coronada, Coronado, California, on November 13, 14 and 15, 1960.

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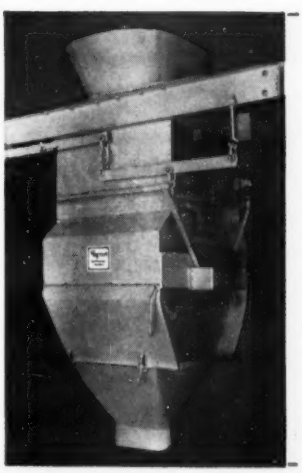

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George E. Smith, chairman of the Department of Soils at University of Missouri, presided as chairman of the Middle West Agronomists.

Midwest Meeting Drew Record Crowd

More than 700 industry representatives and agronomists met at Chicago for twelfth annual conference

Attendance passed the 700 mark as fertilizer industry representatives and college agronomists came together for their twelfth annual joint meeting in Chicago February 11-12.

The meeting, sponsored by the Midwest regional office of National Plant Food Institute, featured a novel program arrangement. After each report from one of the state land grant college experts about their research, a qualified fertilizer industry representative followed-up with an interpretation of the significance of the research to the industry.

George E. Smith, chairman of the Department of Soils at University of Missouri and chairman of the Middle West Agronomists, presided at the initial session Thursday afternoon.

Ohio agronomist Harold Shoemaker and county agent Oscar Share told about the Guernsey County soil fertility program, and Harry Cook of Farm Bureau Cooperative Association, Columbus, interpreted the significance to the industry.

Ohio agronomist Gordon Ryder and county agent Norman Arnold explained the Miami County demonstration program and Bert Tucker of Sohio Chemical Co., Lima, gave a run-down on what the program means to the industry.

J. F. Davis of the Michigan State University Department of Soil Science reported on research progress in his state, and A. H. Bowers of Swift & Co., Chicago, related its importance to the industry.

S. A. Barber of the Purdue Department of Agronomy told of research in Indiana, and Loren Johnson of U. S. Steel Corp., Pittsburgh, detailed the significance of this work.

The Friday morning session, under the gavel of M. B. Russell, head of the University of Illinois Department of Agronomy, began with the showing of NPFI's new film "Bread from Stone," which tells the agricultural story for non-farm people.

The agronomists' report on recommended grades and ratios for the Midwest was released at this session (see page 58 for complete table).

C. M. Woodruff of the University of Missouri Department of Soils described research there and Victor Sheldon of Olin Mathieson Chemical Corp., St. Louis, interpreted for the audience.

L. O. Fine, head of the Agronomy Department at South Dakota College of Agriculture, reported on research in his state and W. M. Mierke of Tennessee Corp., St. Louis, told its significance to the industry.

"The Farmer, the Dealer and Fertilizer Sales" — a fast-moving presentation by George Beal and Joe Bohlen, rural sociologists at Iowa State University—brought the audience up to date on their studies probing into the significance of various marketing factors in fertilizer distribution.

Here is a run-down on some of the highlights of the reports:

Top: George Beal and Joe Bohlen, rural sociologists from Iowa State University, outline dealer study on flannel board.

Below: Ed R. Schumann, John Guttay, Zenas Beers and Arlan Woltemath of NPFI's Midwest staff check notes during the meeting.

AT THE MIDWEST MEETING

1. Jim Menn, U. S. Industrial Chemicals; Bert Tucker, Sohio Chemical Co.; and C. L. W. Swanson, Texaco Inc.

2. George Cosper, Sohio Chemical Co.; Dallas Cantwell, Southern Nitrogen Co.; and James W. Rogers, Sohio Chemical Co.

3. Victor Sheldon, Olin Mathieson Chemical Corp., and C. M. Woodruff, University of Missouri.

4. A. C. Caldwell, Univ. of Minnesota; R. W. Starostka, W. R. Grace & Co.; and Lowell Hanson, Univ. of Minnesota.

5. Russell Pisle, Sohio Chemical Co.; Ray Sorenson, Cornland Plant Food; and W. B. Van Wylen, Allied Chemical Corp.

6. Bill Threadgill, Spencer Chemical Co., and Arlan Woltemath, NPFI.

7. Leonard Schrader, Standard Oil; Arlan Woltemath, NPFI, and Bill Sime, Spencer Chemical Co.

8. John Abbott, Ashkum Fertilizer Co., and George C. Kempson, Monsanto Chemical Co.

9. George Scarseth, American Farm Research Ass'n., and Emil Truog, Univ. of Wisconsin.

10. Charles Martin, Miami Fertilizer Co., and George Enfield, U.S.D.A.

11. Emil Truog, Univ. of Wisconsin; James Schell, Kingsbury & Co.; and A. C. Norris, V. W. Norris & Sons.

12. George E. Garland, Texaco Inc.; Glenn Bunting, Central Farmers Fertilizer Co.; and Joe Whittington, Olin Mathieson Chemical Corp.

13. C. A. Johnson and Phil Stocker, Land O'Lakes Creameries.

14. Pat Davis and Joan Domkowski, of NPFI's Midwest staff, who 'manned' registration desk.

15. Merle E. Ward of DuPont; and R. J. Finch of Balfour, Guthrie, Inc.

16. A. H. Bowers, Swift & Co., and J. F. Davis, Michigan State Univ.

17. John Falloon, Univ. of Missouri; Ben Allen and Joe Stough, U. S. Borax & Chemical Corp.

18. Warren Huff and John Foy, Ashcraft-Wilkinson Co.

19. E. D. Longnecker, Michigan State Univ.

20. S. A. Barber, Purdue Univ., and Loren Johnson, U. S. Steel Corp.

Results of an intensified soil fertility program that could add $1,000,000 to the farm income of Guernsey County, Ohio, were summarized in a report by Dr. Harold Shoemaker, Ohio State University Extension agronomist, and Oscar Share, agricultural extension agent of Guernsey County.

More than 665 soil samples were taken from Guernsey County farms during the campaign, or twice as many as have normally been taken in an entire year and were processed through the university soil laboratory. Soil sampling has been the foundation of the program, the Ohio specialists said.

This project has been sponsored by a recently organized Guernsey County Agronomy Committee. Its membership includes representatives of the Agricultural Extension Service, Soil Conservation Service, ASC, FHA, vocational agriculture teachers, and lime, fertilizer and seed dealers.

As a preparation for the program, a series of three Fertilizer Dealer Short Courses was held in Guernsey County to train dealers to be qualified to serve as soil fertility consultants to farmers.

Altogether, 37 soil collection stations were set up in the county. The committee asked lime and fertilizer dealers doing business in the county to pay half the cost of soil sampling during the campaign.

A hard-hitting publicity campaign helped. This included special newspaper sections, radio programs, posters and slide sets, special articles for newspaper use. Endorsements were obtained from local congressmen. The county commissioner was asked to declare county fertility weeks. Special movies were used during the soil sampling phase of the project.

National Plant Food Institute provided soil sampling probes and 1000 copies of an illustrated presentation on "How to Take a Soil Sample." The Institute also furnished illustrated mats for newspaper advertising to help promote the project. Zenas H. Beers, NPFI Midwest regional director and Dr. Samuel L. Tisdale, Southeast regional director of the Institute cooperated with information and suggestions on how to develop, operate and promote the program.

A complete survey has not yet been completed. However, one lime dealer sold more lime two months after the program was undertaken than he had spread in the entire preceding year. And some fertilizer dealers could not keep up with the demand for plow-down nitrogen fertilizer for corn and had to suggest side-dressed applications.

The second annual soil fertilization program will be launched March 17.

Farmers who cooperated in an intensified fertilizer demonstration program in Miami County, Ohio, got back $2 for every dollar invested in fertilizing pasture, despite a droughty 1959 season and a 9-inch shortage in rainfall.

That was the report of Dr. Gordon Ryder, Ohio State University extension agronomist and Norman Arnold, Miami County extension agent.

Individual increases in hay yields as high as 2100 pounds per acre were reported on some farms. The average increase in yield was 1235 pounds per acre. All of the demonstration plots received higher fertilizer applications than did neighboring check plots.

Altogether, 57 farmers cooperated in this research project which was aided by a National Plant Food Institute financial grant. There were 10 pasture fertilizing tests and 47 corn fertilizing demonstrations in the program.

On cooperators' farms, yields on heavily fertilized fields were 15 to 20 bushels higher than on check plots. Where moisture and plant populations were inadequate, yields averaged 9 bushels higher through heavy fertilization.

Dr. Ryder said that a reasonably high corn population is satisfactory even in dry seasons, when sufficient fertilizer is applied.

He pointed out that the demonstration program was unique in these respects: (1) Cooperating farmers bought their own fertilizer; (2) Through the cooperation of 18 fertilizer companies doing business

1. Zenas Beers and Raoul Allstetter, NPFI, and Ralph E. Fraser, Summers Fertilizer Co.

2. Wes Neu, Plant Food Equipment Co., and Frank Walter, Deere & Co.

3. H. Vice Miller, Armour Agricultural Chemical Co.; Tracy Adcock, Swift & Co.; and Cash Cahill, F. S. Royster Guano Co.

4. Bill Mierke, Tennessee Corp., and Dr. F. E. Shubeck, S. Dakota Agricultural College.

5. E. T. Potterton, International Minerals & Chemical Corp.; Paul Potterton, Univ. of Wisconsin; and John Zigler, International Minerals & Chemical Corp.

6. Richard Timmons, Agricultural Lab.; C. M. Woodruff, Univ. of Missouri; and James C. Britton, U. S. Borax & Chemical Corp.

7. R. U. Mesdag and Tom Rogers, Allied Chemical Corp.

8. Leo Orth, Sinclair Petrochemicals; Werner Nelson, American Potash Inst.; and Garth Volk, Ohio State Univ.

9. William G. Cox and R. G. Searl of Wm. G. Cox Co., and John Guttay, NPFI.

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in the county, 23 salesmen served as demonstration supervisors; 95 per cent of the demonstrations were completed as planned.

Farmer-demonstrators were assigned to the project supervisors regardless of the brand of fertilizer the demonstrator used.

The program had the support of Miami County Agronomy Committee. A public relations program via local newspapers and radio stations generated public interest in the project. During the season more than 600 persons participated in tours and meetings and personal visits to demonstration sites in connection with the program.

The attitude of the farmer cooperators is indicated by the fact that more than 75 per cent of them have agreed to repeat the same demonstration program in 1960.

Band placement of fertilizer has boosted small grain yields as much as 15 bushels per acre, according to Dr. J. F. Davis, Michigan State University soils scientist.

In these yield-building tests in Saginaw County, Michigan, 600 pounds of a fertilizer supplying nitrogen, phosphate and potash per acre was applied in a band to the side and an inch below seed level.

This method puts the nutrients within easy reach of the roots and has the advantage of keeping the plant food from direct contact with the seed. Research men have been able to use up to 1200 pounds of fertilizer per acre in the band without injury to small grain plants.

Dr. Davis reported that the early growth of sugar beets can be increased threefold by adequate fertilization. The fertilizer gets the young plants off to a faster, more vigorous start, facilitates the job of blocking and cuts down the competition of weeds.

"Regardless of how much plant food is put on ahead of time, sugar beets need some fertilizer at planting time to stimulate early growth," he said.

Profitable applications of up to 800 pounds of superphosphate (P_2O_5), with row applications of 150 pounds of 5-20-20 fertilizer per acre have been made in Michigan tests, he stated. Michigan farmers are applying an average of 587 pounds of fertilizer to their sugar beet crops.

Recent research on minor elements indicates a need for molybdenum by truck crops, such as onions, cauliflower, broccoli, cabbage and spinach in organic soils; and by red clover in mineral soils, Dr. Davis said.

"We are also running into zinc deficiencies on the corn crop in some areas," he reported.

Dr. Stanley A. Barber, of the Purdue University agronomy staff, said Indiana farmers are now using an average of 185 pounds of fertilizer per cultivated acre, compared to 135 pounds a decade ago.

"At the same time, the fertilizer industry has been able to increase the plant food content of the fertilizer from an average of 26 units to 40 units per ton," he said. This combination makes a 120 per cent increase in the per acre use of plant nutrients in Indiana during the past 10 years."

Dr. Barber said that research on methods of applying phosphate fertilizer during the past eight years indicates that where more than 40 pounds of phosphate per acre is being applied, it is better to plow under most of the amount and use a small amount in the row than to use it all as a row application.

"Corn only takes up phosphate from row fertilizer during the first month of growth," he reported. "Phosphate needs to be plowed under to supply the corn crop later in the growing season."

Experiments over a three-year period indicate that, on the other hand, potash can be applied either in the row or plowed under for corn with equal effectiveness, because corn is able to take up potash from the row application all through the season.

Nitrogen does a better crop feeding job when the soil is well supplied with phosphate and potash fertilizer, Dr. C. M. Woodruff, University of Missouri soil scientist reported.

Dr. Woodruff cited tests at the Sanborn Experimental Field, Columbia, Missouri, where Sudan grass was used as the "yardstick" for measuring the recovery by crops of nitrogen added to the soil.

"The percentage of added nitrogen recovered by Sudan grass ranged from as much as 48 per cent where the past 70 years of cropping had included full treatment with chemical fertilizer, to only 12 percent on land that had been cropped to different systems without soil treatments," he said.

The high rate of nitrogen recovery by the Sudan grass crop was from land in continuous wheat which had received full applications of phosphate and potash fertilizer.

Results of tests in 1958 and 1959 indicate that the phosphate requirements of corn growing in soils very low in phosphate can be met by banding 50 pounds of P_2O_5 near the seed at planting time, provided the phosphate is accompanied by small amounts of nitrogen in the ammonium form, Dr. Woodruff said. Ideal fertilizers for side placement with corn would be the 1-3-1, 1-4-1 and 1-4-2 ratios, he indicated.

"Additional nitrogen which is usually needed, and phosphate and potash for raising the level of these elements in the soil, may be spread and plowed under ahead of the crop," Woodruff reported.

Irrigation plus adequate fertilization can boost corn yields as much as 50 to 65 bushels per acre, Dr. F. E. Shubeck, South Dakota Agricultural College agronomist, told the meeting.

"In areas where we can get 50 to 60 bushels of corn under dry land conditions, we can expect 100 to 125 bushels under irrigation," he said.

He reported that fertilizer recommendations for irrigated land advise the use of two to three times as much nitrogen and about twice as much phosphate as for dry land, on soils well supplied with potash.

About 107,000 acres of South Dakota farm land are now under irrigation, Dr. Shubeck said.

"There may be 700,000 acres in the future," he added, "depending on how farmers vote in potential ir-

KEY TO PICTURES

1. Gene Van Deren, Blue Grass Plant Foods; Bernie Machen, Armour Agricultural Chemical Co.; and John W. Hall, Potash Co. of America.
2. Bernie Machen, Armour Agricultural Chemical Co.; Joe F. Stough, U. S. Borax & Chemical Corp.; Yontz Bonnett, Jr., Hoblit-Bonnett Fertilizer Co.; and Nelson T. White, Columbus, O.
3. Jim Devlin, Southwest Potash Corp.; C. E. Workman, U. S. Phosphoric Products Div.; and T. E. Camp, Southwest Potash Corp.
4. Laurie Peterson, Midland Coop.; Lee Hays, Chemlizer Corp.; Frank Nelson, Rath Packing Co.; and Tony Horehled, Sinclair Petrochemicals.
5. Paul E. Nelson of Aubrey, Finley, Marley & Hodgson; Louis Wilson, NPFI; Bill Mason, Radio Station WLS; and Dean Neill of Aubrey, Finley, Marley & Hodgson.
6. W. P. Martin, Univ. of Minnesota; Russell Coleman, then with NPFI; Werner Nelson, American Potash Institute.
7. Chuck Trunkey, U. S. Industrial Chemicals; James McIntosh, National Fertilizer Co.; and Tom Martin, U. S. Industrial Chemicals.
8. Kirk Wagenseller, Swift & Co.; Robert Fitzgerald, Smith-Douglass Co.; and H. C. Hopewell, Swift & Co.
9. Gordon Cunningham, Tennessee Corp.; Bill Porterfield, Freeport Sulphur Co.; Lucky Luckhardt, Collier Carbon & Chemical; and Tom Cox, American Cyanamid.
10. Delno Knudsen, Univ. of Nebraska, and Orlo Musgrave, Ohio State University.
11. Robert Bohannon, Kansas State University.
12. Joe Sharp, Spencer Chemical Co., and Bob Garn, Central Farmers Fertilizer Co.
13. Charlie Martin, Percy Kent Bag Co., and Robert E. Maron, International Minerals & Chemical Corp.
14. Dave Van Aken, Spencer Chemical Co., and Bruce Barton, Percy Kent Bag Co.
15. Gordon Ryder, Ohio State Univ., and Norman Arnold, Miami County, Ohio.
16. R. P. Thomas, International Minerals & Chemical Corp., and Paul Marshall, Commercial Solvents.
17. C. J. Chapman, Univ. of Wisconsin, and M. B. Russell, Univ. of Illinois.

rigation districts."

Small grains gave good yield responses to nitrogen fertilizer, in tests with tillage, fertilizer and rotations in South Central South Dakota, according to Dr. Shubeck.

Discussing tests with continuous corn, he reported that even though drouth and high temperatures set a "ceiling" on corn yields in 1959, an increase of about 15 bushels per acre was obtained on fertilized continuous corn plots.

Fertilizer-using farmers could profitably use three times the amount of plant food they are now applying, according to two Iowa State University rural sociologists —Dr. Joseph M. Bohlen and Dr. George M. Beal.

Bohlen and Beal cited a recent Iowa survey which indicates that dealers play a key role in influencing farmers' decisions about fertilizer use. The survey covered 315 farmers who work 40 or more acres each. It also included 118 fertilizer dealers.

More than 96 per cent of the farmers interviewed said they expect dealers to be a "reliable source of information about fertilizer use."

"It appears that dealers can be motivated to do a top education and merchandising job," they added. "The fertilizer industry along with other groups have an opportunity and a responsibility to help get the job done."

The survey indicated that "progressive" dealers: (1) Sell above average amounts of fertilizer; (2) Offer more educational services such as soil sampling programs, fertilizer clinics and test plot demonstrations; (3) Offer more fertilizer spreading services and (4) Believe the farmer wants them to be a consultant on fertilizer matters and thinks the dealer should try to influence the farmer.

Dealers who take soil samples for farmers, who send in soil samples and help interpret soil test recommendations for farmers have the following characteristics, according to Bohlen and Beal:

These dealers maintain a relatively high mark-up on fertilizer over purchase cost—an average of 9.3 per cent. They have a relatively high gross profit margin on fertilizer. They regard the fertilizer business as "excellent," or a business with "great potential."

They see their fertilizer department as a money maker in itself rather than a customer service or not a money-maker; are less worried about fertilizer competition; help the farmer plan his fertilizer program; have a relatively high knowledge of fertilizer; tend not to offer volume discounts or credit.

Bohlen and Beal reported that if the dealer is to be motivated to push fertilizer, it will take "well planned and implemented programs backed up by financial and qualified human resources."

"The day of the industry salesman, price detective, or order-taker is passing out of the picture," they concluded. "The alternative may be the well trained specialist who can give expert advice on business and farm management and sales and educational programs as well as information on fertilizer and fertilizer use."

State Agronomists' Suggested Minimum Fertilizer Grade Needs of the Middle West for the Year Beginning July 1, 1960*

Ratio	Illinois	Indiana	Iowa	Kansas	Kentucky	Michigan	Minnesota	Missouri	Nebraska	N. Dakota	Ohio	S. Dakota	Wisconsin
0:1:3	0-10-30	0-10-30				0-10-30	0-10-30	0-10-30			0-10-30		0-10-30
0:1:2	0-10-20	0-10-20	0-15-30		0-10-20	0-10-20							
0:1:1	0-20-20	0-20-20	0-20-20	0-20-20	0-20-20	0-20-20	0-20-20	0-20-20			0-20-20		0-20-20
0:2:1	0-20-10	0-20-10	0-20-10			0-20-10	0-20-10			0-20-10	0-20-10		0-30-15
1:6:3						4-24-12		4-24-12		4-24-12			
1:4:1						5-20- 5							
1:4:4	4-16-16	5-20-20	5-20-20	5-20-20	4-16-16	4-16-16	5-20-20		5-20-20		4-16-16		5-20-20
1:4:2	6-24-12	6-24-12	5-20-10			5-20-10	6-24-12		5-20-10		4-16- 8	6-24-12	6-24-12
1:3:9	3- 9-27	3- 9-27				3- 9-27		3- 9-27					3- 9-27
1:3:2					4-12- 8								
1:3:1				8-24- 8		8-24- 8		8-24- 8					
1:2:4			6-12-24			5-10-20	5-10-20						
1:2:3		5-10-15			5-10-15						5-10-15		
1:2:2		8-16-16	8-16-16		5-10-10	8-16-16	8-16-16	8-16-16			8-16-16		8-16-16
1:2:1			10-20-10	10-20-10		10-20-10	10-20-10	12-24-12	10-20-10	10-20-10		10-20-10	
1:1:3					6- 6-18								
1:1:1	10-10-10	12-12-12	12-12-12	12-12-12	10-10-10	10-10-10	12-12-12	10-10-10		10-10-10	10-10-10		10-10-10
1:8:0		5-40- 0											
1:4:0	8-32- 0	8-32- 0	8-32- 0	8-32- 0		8-32- 0	8-32- 0	8-32- 0	8-32- 0	8-32- 0	8-32- 0	8-32- 0	
1:2:0	10-20- 0		10-20- 0	10-20- 0		10-20- 0	10-20- 0	10-20- 0	10-20- 0	10-20- 0		10-20- 0	
1:1:0	15-15- 0		15-15- 0	15-15- 0			15-15- 0		15-15- 0	15-15- 0		15-15- 0	
2:1:2						20-10-20							
2:1:1	20-10-10	16- 8- 8	20-10-10			12- 6- 6	16- 8- 8				14- 7- 7		16- 8- 8
2:2:1						12-12- 6				12-12- 6		12-12- 6	
1:3:0				13-39- 0	8-24- 0		8-24- 0	8-24- 0	8-24- 0	13-39- 0		13-39- 0	
1:2:6						5-10-30	5-10-30						5-10-30
2:1:0			24-12- 0				24-12- 0			24-12- 0		24-12- 0	
4:1:2		16- 4- 8											
3:2:1											15-10- 5		
2:7:1													10-35- 5
2:0:1		24- 0-12				24- 0-12							
1:0:1		15- 0-15											

* The production of higher grades of the suggested ratios is encouraged. Solutions of similar ratios are equally acceptable.

The following changes in grades and ratios have been suggested for future consideration: 0-1-3 (0-10-30) to 0-1-4 (0-10-40); 1-3-9 (3-9-27) to 1-2-6 (5-10-30) or 1-2-8 (4-8-32)

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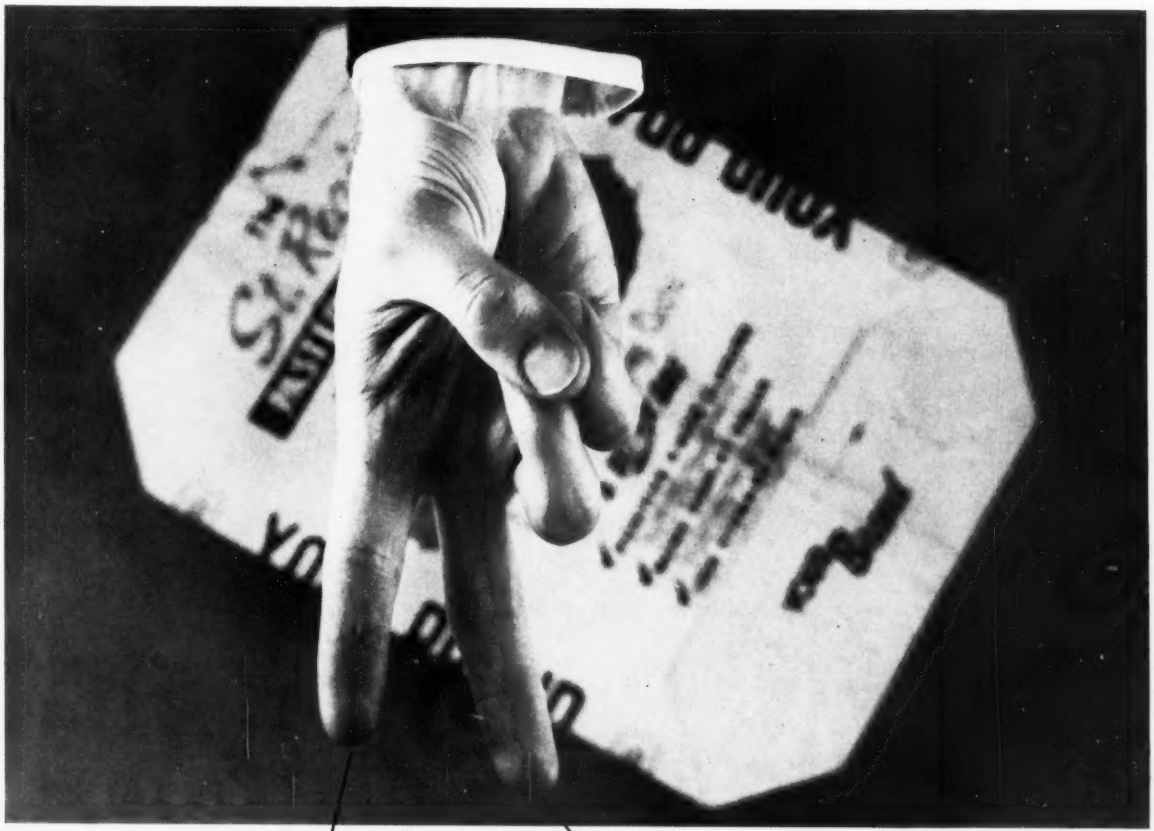

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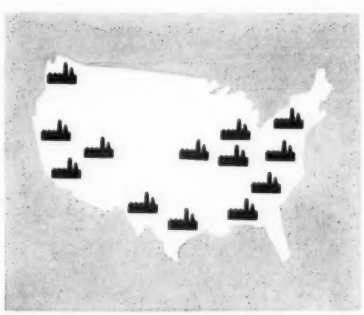

designed to serve *you*, the bag user, better than ever before. Besides the thirteen bag manufacturing plants, it includes thirty-three sales offices throughout the country for fully integrated sales and service to meet both your domestic and export bag shipping requirements.

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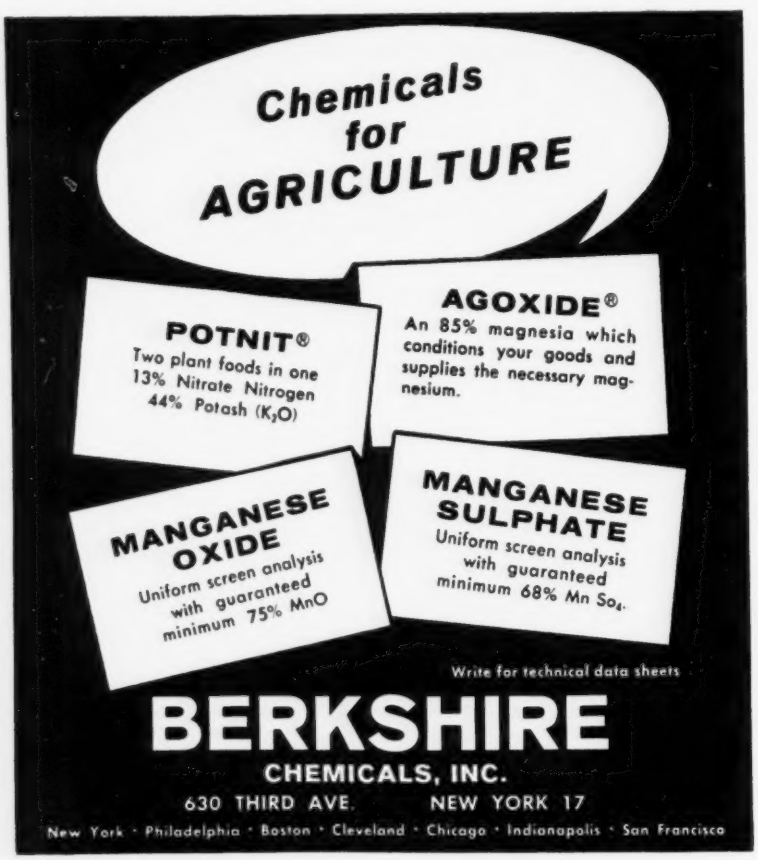
—of This and That . . .

——Davison Chemical's Bill Caspari, who suffered a heart attack December 14 (he described the coronary occlusion sensation as feeling that "two big wolves knocked me down and started tearing the flesh from my chest") reports quite a bit of progress, and says he feels ever so much better every day. Bill spent six weeks in the hospital, and is presently confined to the second floor of his home for an indefinite stay.

——Mrs. Oscar F. Smith and her daughter, Mrs. Roy Charles, of Norfolk, have given $75,000 to purchase, restore and furnish an old house in historic Bath, N. C. The gift is in memory of the late Oscar F. Smith, native of Bath and co-founder of Smith-Douglass Co. It will be used to restore the more than 200 year old Bonner house on Bonner's Point in Bath, the oldest incorporated town in North Carolina, which is now in the midst of a long range restoration project.

——A side benefit of the aerial spraying program to rid Union County, Arkansas of fire ants was noted recently in the ARKANSAS GAZETTE. The county agent and an entomologist from the state university found that the heavy tick population on the county's dogs had been reduced to almost nothing. A check of 24 dogs in an area sprayed in 1957 yielded only five ticks, an average of .208 per dog; in an area sprayed in 1958 they found seven ticks on 17 dogs, .41 ticks per animal. In untreated sections of the county, however, 18 dogs yielded a crop of 387 ticks . . . 21.5 per dog. They calculate that it will be many years before the tick population in treated areas builds back to its former level.

——Agricultural economists are worried about the increase in the number of 15-acre-and-less wheat farms, as more and more farmers discover that these small tracts are immune to acreage controls. The number of these units has climbed from 816,000 in 1955 to 1,300,000 now, and it is estimated that they have contributed 385 million bushels to the Federal pile in the past four years. To complicate the problem, they are growing increasing quantities of inferior wheat which will either have to be dumped into government-subsidized export sales or added to the surplus stockpiles.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Woodle Sees Added $524,000,000 for S.C.

South Carolina farmers can increase their gross farm income by over 524 million dollars. This is the word from H. A. Woodle, Extension Agronomist with the South Carolina Agricultural Extension Service. Mr. Woodle says that this increase is possible if farmers will follow recommended fertilizer, lime, and other good management practices.

Over half of this increase or over 280 million dollars can come about from better management of pastures. South Carolina statisticians figure that their 3,500,000 acres of pasture land in the State will produce an increase of 400 pounds of beef per acre. Mr. Woodle says that if such land is fertilized at a general rate of about one thousand pounds of mixed fertilizer per acre and 100 pounds of N then these increases will be possible.

While Mr. Woodle feels that it perhaps may take several years to reach this goal of 524 million dollars for this State, he is optimistic about the chances. South Carolina has embarked on a series of county soil fertility programs which are dedicated to increasing the efficiency with which the farmers produce their crops. The program is already under way in seven South Carolina counties with additional counties scheduled to come in at various times in the coming year.

Mississippi Finds Need for More Sulphur

Dr. Russell Coleman and the newly formed Sulphur Institute will be especially interested in a report which shows a need for higher sulphur levels in fertilizer.

At the Mississippi AES, Howard Jordan reports that "commercial fertilizers which formerly carried high percentages of sulphur, now have almost negligible amounts of this element. In time this may seriously affect crop yields" he says.

The reason, where coal is burned, sulphur is discharged into the air and brought to earth in rainwater. But so many industries are now converting to oil that the sulphur in the atmosphere is being reduced.

Sulphur from insecticides is also being reduced, he says.

Florida Soil Needs Potash

C. N. Nolan, Florida AES, says available potash found in most Florida soils is not sufficient for economic production of crops without the addition of fertilizer potash.

IT ALL COMES DOWN TO THIS CRITICAL POINT

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Fluid Bed Dryer

Raymond Division of Combustion Engineering, Inc. has issued a new bulletin on Fluid Bed Dryers. Six page, two color Bulletin 88 covers principles of the system, sections on design and operation, plus tips on information needed to analyze the drying problem. In addition, it offers the help of C-E Raymond engineers with their technical and laboratory facilities in appraising individual drying problems.

For your copy of the new booklet, circle number 1 on CF's Information Service Bureau card, page 63.

Belt Weigher Integrator

A new, simplified pneumatic integrator for accurately weighing material passing over conveyor belts of its continuous weighers has been announced by B-I-F Industries, manufacturers of process instrumentation, equipment and systems.

The new Integrator-Totalizer automatically integrates (multiplies) belt travel with belt loading to pro-

duce direct readout of the true weight being conveyed over the weighing section of the Builders-Providence Conveyoflo flow meter for bulk dry materials.

The compact Integrator utilizes two components: a precise force-balance positioner and a disc-and-wheel integrator mechanism. The 7-digit totalizer is direct reading in pounds, tons, long tons, etc., and does not need multipliers other than ciphers. Mounted in a dustproof, rubber-gasketed steel case with cast aluminum door, the linear response integrator is highly sensitive, explosion-proof, uses less than 0.3 standard cubic feet per minute (SCFM) air consumption, and is adaptable for electric contactors for operating remote totalizers.

For Bulletins 550.20 A-1 and 550.20-1 on the new continuous weighers for dry materials, circle number 2 on CF's Information Service Bureau card, page 63.

Multiple-Tube Cooler

How Allis-Chalmers multiple-tube cooler (Warner type) operates to save money five ways is told in a new leaflet released by the company.

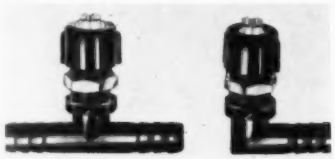
The cooler is designed to provide low-cost cooling of fine, soft or granular materials, including lime, dolomite, magnesia, alumina, clays, fuller's earth, etc.

Copies of the leaflet, 22B9290, are available by circling Number 3 on CF's Information Service Bureau card, page 63.

Nylon Hose Connector Nozzles

Delavan Manufacturing Company has announced addition of nylon hose connector nozzles to its line of agricultural sprayer nozzles and accessories.

Designed as a simple, inexpensive method of producing a corrosion resistant boom, the connector nozzles can be used with ½" corrosion resistant hose with single or channel iron boom. They are available as "T" double hose inlet and 'L' single hose inlet. The 'L' connectors will be needed for boom and end noz-



zles. Lock nuts are supplied as standard equipment with these connector nozzles.

For complete information on the new corrosion and weather resistant nylon hose connector nozzles circle Number 4 on CF's Information Service Bureau card, page 63.

Dust Control Brochure

'Freedom from Dust' is the title of a new 28-page brochure just published by Dracco Division of Fuller Co.

Now available as Bulletin No. 805, it describes a complete range of dry collection equipment. Shown are ways of using cloth filtration and cyclonic equipment for eliminating dust control and air pollution problems.

Illustrated application data shows how industry uses this equipment effectively to collect waste dust or to return valuable, reusable material to the manufacturing process.

For copies of 'Freedom from Dust' circle number 5 on CF's Information Service Bureau card, page 63.

Fertilizer Equipment Catalog

Of interest to liquid fertilizer solutions dealers is Catalog No. 60 just issued by Schelm Brothers, Inc.

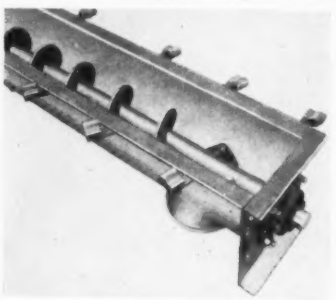
A full line of tanks and application equipment is illustrated with tanks in both aluminum and stainless steel, pull-type applicators using either air pressure or roller pump, spray boom equipment, 'Jumbo' top-dressing units, and many other items.

Catalog No. 60 and dealer's net price list is available free by circling number 6 on CF's Information Service Bureau card, page 63.

Stainless Steel Conveyors

A new line of stainless steel helicoid screw conveyors and ribbon flight conveyors with special design features to meet sanitary requirements of chemical and food industries has been announced by The Bucket Elevator Company.

Conveyors are available in sizes from 4" to 12" in diameter. Standard features include outboard mounted bearings with inboard, removable mechanical seals or stuffing boxes; hinged, drop bottom



troughs held in place by quick-opening clamps; top covers secured by pivoted 'U' type clamps or toggle clamps. Dust tight operation is assured by the use of food grade hollow core and bead neoprene gasketing.

Complete information is available by circling number 7 on CF's Information Service Bureau card, page 63.

Flip-Top First Aid Box

A new flip-top box for multiple-use first-aid units is described in a bulletin issued by Mine Safety Appliances Company.

The illustrated release highlights construction features of the new container, including resistance to tearing after frequent use, sealed-in protection against dust or grime, and improved convenience in extracting items.

M-S-A first-aid items in the new package are listed as ammonia inhalants, iodine brushes, merthiolate swabs, waterproof adhesive bandages, plastic adhesive bandages, two-inch compress bandages, Foille liquid for burns in two sizes, and Foille ointment for burns.

The bulletin, No. 0401-8, is available on request by circling Number 8 on CF's Information Service Bureau card, page 63.

Universal Indicating Transmitter

A new line of pneumatic indicating transmitters for pressure, flow, temperature, liquid level, differential pressure, and dew point has just been introduced by The Foxboro Company manufacturers of industrial instrumentation.

Known as the Model 45 Series, the new line features measuring elements specifically designed for each major process variable. The transmitter is available with measuring elements in the following ranges: Pressure—0-10 inches water to 0-80,000 psi; Temperature—450F to +1000F (—270C to +500C); Flow differential pressure)—0-1 to 0-400 inches water; Liquid level — open vessels 0-10 inches water minimum.

Closed vessels 0-20 inches water minimum; Dew Point— —50F to +165F. Output signal: 3-15 psi (3-27 psi optional). Operates on a 20 psi air supply.

The Model 45 has high ambient temperature stability, with less than ½ percent error for ambient temperature changes as great as 50F, regardless of the variable measured. This stability is accomplished by careful matching of measuring elements and transmitter units. Overall calibrated accuracy of the transmitter, including measurement and output signal, is guaranteed to be within +½ percent.

Featuring link and lever calibration and a minimum of moving parts, the Model 45 is easy to adjust and maintain. Its large 6⅛-inch scale and fluorescent pointer make for high-visibility local indication.

All instrument components are enclosed in a weatherproof steel case which has corrosion-resistant vinyl coating, gasketed door. Overall case dimensions: 9¼ by 11⅜ by 5 inches. A universal bracket is supplied for surface or 2-inch pipe mounting.

For more information, circle number 9 on CF's Information Service Bureau card, page 63.

Load Cell Weighing System

Their new load cell weighing system is the subject of a four-page brochure issued by The Howe Scale Company.

Typical heavy-duty applications, such as motor truck scales, railroad track scales, automatic batching, check weight scales, tank or hopper scales, and crane hook scales are described and illustrated in this new brochure.

Advantages of the Howe system, which is available for installations involving 500 lbs. to hundreds of tons, are outlined. Detailed drawings and photographs graphically describe the actual operation of the Howe Load Cell System.

Copies of this new brochure are available free by circling Number 10 on CF's Information Service Bureau card, page 63.

New 'Jetslingers' Folder

A new six-page folder describes the three types of Link-Belt Company Jetslingers equipped with short, high-speed belt conveyors for hurling free-flowing bulk materials into areas inaccessible by other mechanical means. The folder describes and illustrates both the suspended, swiveling and wheel-mounted units which are used for hurling material into storage in warehouses, boxcars, holds of ships, bins or upon the ground. Dimensional data is also given.

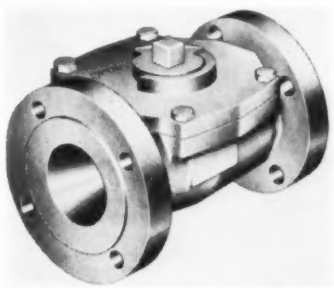
Jetslingers are available with belt widths of 14, 20 and 28 in. and capacities of up to 700 t.p.h. with materials weighing 50 lbs. per cu. ft.

'Jetslingers,' Folder 2721, can be obtained by circling number 11 on CF's Information Service Bureau card, page 63.

Flo-Ball Valve

A new series of Flo-Ball valves, featuring the ball mounted in fixed bearings, and easy servicing without removal from the line, is now available in sizes ranging from one to ten inches for off-the-shelf delivery to industrial users, according to an announcement by Hydromatics, Inc.

Designated Series 711, it is engineered around the fixed bearing



principle; the ball rotates on a fixed axis between bearings that require no lubrication, and can absorb tremendous impacts and loading without back-lash or danger of distortion.

Design makes it possible to disassemble and service the valve without removing it from the line.

The seats are replaceable. They are balanced, self-aligning and self-adjusting for controlled seat loading and positive sealing. The operating spectrum ranges from —20°F + 400°F, and pressures from vacuum to 300 psi.

This series includes other important features of the Flo-Ball line including 100% flow efficiency, two-way flow, zero leakage and low torque manual operation. Materials of construction include semi-steel, 316 stainless steel, carbon steel and aluminum. Flanges are ASA standard 125 and 150 pound.

For complete information, circle number 12 on CF's Information Service Bureau card, page 63.

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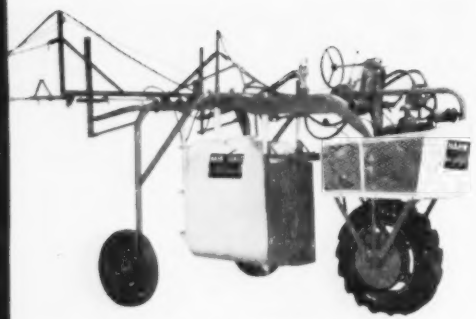

New 'Hi-Boy' Sprayer

A new low-priced Hi-Boy (Model H-180) has been added to the line of Hahn, Inc., high-clearance sprayer manufacturer. Priced at about $1,000 less than the firm's deluxe model, the new machine is designed to provide low-cost economical spraying for any size farm.

The H-180 has many of the same features as the top priced Hi-Boy Sprayers, including aluminized-steel tank (150 gal.) and 8-row Ever-Level Boom, specially designed for application of liquid fertilizers. Other features include 18 h.p., 2-cylinder Wisconsin engine with 4-speeds forward (from 2½ to 16 m.p.h.) and one reverse; new "Live" Pump Drive for instant spray pattern; tread width adjustable to work 38", 40," and 42" rows; boom height adjustable from driver's seat from 1' to 12'; 72" frame ground clearance; slope-type fenders optional.

For full details circle number 13 on CF's Information Service Bureau card, page 63.

Screw Conveyors, Feeders

A comprehensive book devoted to the versatile applications and selection of screw conveyors, screw feeders and components has just been released by Link-Belt Company. The 76-page Book 2989, illustrates over 20 different types of screws, 14 types of troughs, with 4 types of covers, 5 types of discharge openings and two types of feeders. The book shows how screw conveyors are used for conveying and elevating, distributing, reclaiming, collecting, mixing, blending, agitating, aerating, heating and cooling materials.

Book 2989 contains an extensive list of materials for which the conveyors may be used. A copy of 'Screw Conveyors and Screw Feeders' may be obtained free by circling number 14 on CF's Information Service Bureau card, page 63.

Vibrating Feeder Book

Link-Belt's complete line of Motorized Counterweight vibrating feeders, more than 60 sizes, are illustrated and described in a new Book 2869, "MC Vibrating Feeders."

These machines are compact, low headroom devices for feeding a wide range of bulk materials at a uniform rate from bins, hoppers, storage piles or conveyors. The new 12-page publication contains illustrations of both the single and twin motor types in either floor mounted or cable suspended models.

Selection and application information is given on the company's feeders in all size ranges—trough lengths from four to 14 feet; trough widths from one to six feet and capacities from five to 1700 tons per hour. Two pages are devoted to 15 illustrations of the many possible applications for MC vibrating feeders and a chart shows the variations possible in cable suspension or floor mountings. Vibrating feeders with pre-designed hoppers and special modifications such as scalping decks and live-bottom hoppers are also illustrated.

A copy of Book 2869, "MC Vibrating Feeders," is available free by circling number 15 on CF's Information Service Bureau card, page 63.

Pneumatic Conveying Article

Availability of a technical article describing auxiliary or supplemental values obtained from pneumatic conveying has been announced by Sprout, Waldron & Company. The article discusses heat transfer, cooling and drying, size reduction and size separation.

This paper, originally presented before the Process Industries Division of The American Society of Mechanical Engineers, points out that there are many auxiliary uses of pneumatic conveyors which can frequently provide the necessary economic justification for a system which would otherwise be considered too costly.

Copies of Bulletin I-69 are available by circling number 16 on CF's Information Service Bureau card, page 63.

Material-Level Indicators

Fuller material-level indicators are now designed for hazardous dust locations, as well as for general purpose use. Underwriters' Laboratories, Inc., has approved Fuller Model SG-4X for use on hazardous dust locations (Class II, Groups E, F and G). Model SG-4 is designed for all general purpose applications.

The models are identical in operation and dimensions. They contain interchangable parts and wiring, except that Model SG-4 contains a gasket between the cover and the body, while Model SG-4X has metal to metal surfaces and a paddle shaft bushing machined to UL specifications.

These material-level indicators are used to indicate the level of pulverized, fine, crushed or granular materials in bins and silos, and are used also to control such equipment as feeders, valves, elevators and conveyors. They exercise this control by starting or stopping the motor driving the equipment when a predetermined material level is reached.

For complete information, circle number 17 on CF's Information Service Bureau card, page 63.

Pneumatic Tired Lift

Automatic Transportation Company's all new pneumatic tired gas-powered, electric-driven fork truck features a gasoline engine which transmits its power through a specially designed variable voltage generator to a matched DC series wound electric drive motor, forming a synchronized power package which supplies instant power at the touch of the accelerator. The Dynamotive is designed to provide optimum torque output at a lower RPM requirement. Its fast acceleration and travel speed, up to 9 MPH, are desirable for pneumatic tired industrial lift truck applications.

Advanced engineering principles replace the requirement for a clutch, fluid coupling, fluid torque converter or multiple speed transmission. With no direct mechanical coupling between the engine and drive axle, there is no transmission of road shock.

Controlled inching characteristics of the Dynamotive drive offer better operator performance, safety and lower maintenance. 360-degree circle visibility, accessibility of driver's seat from either side of the truck, plus power steering as standard equipment on all pneumatic tired Dynamotives maximize the driver safety that has been designed into the Dynamotive, which offers a low center of gravity for maximum stability and the largest brakes of any industrial truck.

Bulletin No. 6008-AR (4000 lb. capacity, single drive) and No. 6009-AR (6000 lb. capacity, dual drive) give detailed specifications on both pneumatic tired Dynamotives.

For your free copy of these bulletins, circle number 18 on CF's Information Service card, page 63.

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For many other firms, installing automatic I & C Acto-Cutters on bagger sewing heads has reduced bagging crews by as much as a third.

The 5-Star Plan offers you impressive money-saving opportunities regardless of the size of your operation. Besides packaging machinery this comprehensive service covers bag design, bag construction, specifications control and a detailed survey of your plant.

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PEOPLE in the Industry

NPFI

Paul T. Truitt was elected president of National Plant Food Institute, effective March 1, at a meeting of NPFI's board of directors in Chicago February 10.

Truitt

He succeeds J. D. Stewart, Jr., president of Federal Chemical Co., Louisville Ky., who was elected to the newly-created position of vice chairman of the board of directors. The status of the other officers of the Institute was not changed.

The board abolished the positions of executive vice president held by Mr. Truitt and Dr. Russell Coleman. This action was taken when Dr. Coleman resigned to become president of the newly-formed Sulphur Institute.

The directors emphasized that their action will provide the organization for the vigorous promotion of the Institute's program.

Mr. Truitt has been executive vice president of the NPFI since July, 1955. Previously, he had served for four years as president of the American Plant Food Council.

As executive vice president of industry's national trade association, he has been active in traffic matters, especially in fighting freight rate increases which would ultimately result in an increase in the cost of fertilizers to farmers. He instituted a legislative reporting service for members and has worked cooperatively with the Association of American Fertilizer Control Officials on behalf of uniform tonnage reporting for the fertilizer industry and to procure more up-to-date consumption statistics through the fertilizer control officials. He also has been active in promotion of safety in fertilizer plants.

Farmers M & E Assn.

After almost thirty years of continuous and meritorious service to the farm people and the Agriculture of Alabama, A. N. Culver has retired as secretary-general manager of Farmers Marketing and Exchange Association, Montgomery, Ala., who operate a fertilizer mixing plant at Clanton, Ala. Mr. Culver will be succeeded by O. H. (Dick) Bowden, who has been associated with him as an assistant for the past several years.

Sulphur Institute

Dr. Russell Coleman has been named president of a newly formed international research organization to be known as the Sulphur Institute, it was announced February 10. Dr. Coleman has served as executive vice president of the National Plant Food Institute since its formation in 1955, and was president of National Fertilizer Association prior to that. He will leave his present position to assume his new duties effective March 1, and will be located at the Institute's headquarters in Washington, D. C. The new organization will also have a European office in London.

Coleman

The purpose of the Institute is to expand world consumption of sulphur by appraising its benefits to agriculture and industry through research and education programs. Institute studies will relate to the value of both existing and new uses of sulphur and will be conducted in cooperation with educational, government and other research agencies.

(The Institute's Washington office will be located in the new RCA building at 1725 K Street, N. W., Washington 6, D. C., Telephone—Federal 7-8660, effective March 1, 1960).

Eastman Chemicals

The chemical division of Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, has announced the appointment of S. M. Ryburn and G. J. Taylor as district sales managers for the company's industrial and specialty chemicals in the New England and the eastern Pennsylvania, Maryland, Delaware and southern New Jersey areas respectively.

Mr. Taylor will direct sales activities in the latter area, in which he has served as sales representative for the past 8 years, from the chemical division's offices in Fort Washington, Pa.

Mr. Ryburn will continue to make his headquarters in Framingham, Mass., where he has been a sales representative for the past 7 years.

Ashcraft-Wilkinson

Robert E. Ashcraft has been elected president of Ashcraft-Wilkinson Company to succeed the late Trenton Tunnell, it has been announced by George W. McCarty, chairman of the board.

Ashcraft

Simultaneously, W. Mercer Rowe, Jr., a vice president of the company since 1954, was named executive vice president. O. Ray Yates, manager of the company's Norfolk, Virginia branch has been made a vice president.

Rowe

Yates

Mr. Ashcraft became executive vice president of the company late in 1959. He joined Ashcraft-Wilkinson in 1929.

Mr. Rowe joined Ashcraft-Wilkinson Company in 1947 as vice president and general manager of a subsidiary, Flag Sulphur & Chemical Company, Tampa, Florida. He previously served as assistant manager of the Agricultural Chemicals Division of Penn Salt Manufacturing Company and was a vice president and director of the Florida Agricultural Research Institute.

Mr. Yates joined Ashcraft-Wilkinson Company as a sales representative at the Norfolk, Virginia branch in 1948.

Ashcraft-Wilkinson Company serves as exclusive world-wide sales agents for Duval-Sulphur & Potash Company, Escambia Chemical Corporation and also actively handles other important chemicals for agriculture and industry.

AP&C

Frank McGrane has been appointed manager of the San Francisco office of American Potash & Chemical Corporation, according to an announcement by William M. Clines, general sales manager, Western.

McGrane

In his new position, Mr. McGrane will assume responsibility for AP&CC product sales in the San Francisco territory in addition to his present duties as manager of agricultural chemical sales. Richard Reep, sales representative, will continue to serve San Francisco office customers.

Calvin L. Dickinson has been named director of manufacturing for AP&CC plants at Trona, Calif., and Henderson, Nev., it was announced by Parker S. Dunn, vice president, manufacturing. The change expands Mr. Dickinson's duties to include responsibility for the Henderson plant as well as for the Trona plant where he has headed operations since 1955.

Henry S. Curtis continues as Henderson plant manager reporting to Mr. Dickinson, who will continue to make his headquarters at Trona.

Paul E. McCoy has become manager, Lindsay Chemical sales, for American Potash & Chemical, according to an announcement by A. J. Dirksen, Eastern general manager. He originally joined them in 1955.

Geigy

Geigy Agricultural Chemicals, division of Geigy Chemical Corporation, announces the appointment of John B. Plant to its Western sales staff. He will represent Geigy in Utah and Southern Idaho.

From 1955 to 1957, Mr. Plant was field representative for California Spray Chemical Company in Orange County, California. He then acted as dealers' representative for the L. H. Butcher Company until his appointment by Geigy Agricultural Chemicals.

Curtis & Son

Warren B. Upton, with 19 years of experience in the field of fertilizer sales in New York State has joined the sales staff of C. Roy Curtis & Son, Inc., fertilizer mixer of Marion, N. Y.

V-C

Virginia-Carolina Chemical Corporation has announced the appointment of Robert R. Martin as manager of its purchasing department. Mr. Martin joined V-C in 1951.

Mr. Martin succeeds Douglas W. Laird who was department manager until last March when he was named vice presiednt. Mr. Laird is now in charge of purchasing and traffic.

Mr. Laird said Mr. Martin would be responsible for the administrative functions of the department and would retain his duties in purchasing supplies and equipment.

Bradley & Baker

Thomas Collins has recently joined Bradley & Baker's Atlanta office as a fertilizer sales representative. A resident of Tampa, Mr. Collins will call on and service manufacturers in Florida.

Collins

Central Farmers

Paul Cairns, administrative vice-president of Central Farmers Fertilizer will act as general manager of their Idaho phosphate operations for the time being, replacing Avery Stutts who has resigned. James Colvin is in charge of engineering and process control and Herb Roubidoux is superintendent in charge of the plant's production. Nate Weber became plant purchasing agent in December. At the same time L. E. Quiram became the general purchasing agent of the Company.

Federal Chemical

J. Walter Harding, about whose promotion we ran an item here last month, has not only been made vice - president, administration, but also was re-elected secretary of Federal Chemical Company, Louisville, Kentucky.

Harding

As we told you in February, Mr. Harding has been with the Company for twelve years, and in that time has been traffic manager, manager of purchases, and—for the past year, secretary and controller.

American Cyanamid

Chesson

Lyle

Maywood W. Chesson, Jr. has been named assistant manager of phosphate operations at American Cyanamid Company's Brewster plant according to an announcement by Arthur Crago, manager of phosphate operations.

Mr. Chesson has been with Cyanamid since September, 1947.

A chemical engineer, the new assistant manager is currently serving as chairman of the Florida section, American Institute of Mining, Metallurgical and Petroleum Engineers.

George L. Lyle, Jr., has been named chief engineer at the Brewster plant, succeeding W. J. Pace, formerly of Lakeland, who retired January 1, 1960, after fifteen years service. Mr. Lyle has been with American Cyanamid Company since October, 1947.

A registered professional engineer, Mr. Lyle is a past vice president and secretary of Ridge Chapter, Florida Engineering Society, and past vice president of Florida Section, American Institute of Mining, Metallurgical, and Petroleum Engineers.

Bemis Bro. Bag

F. G. Bemis of Boston, after 20 years as president, was elected chairman of the board and Judson Bemis of Minneapolis president and chief executive officer of the Bemis Bro. Bag Company, it was announced by the company's board of directors. The new president joined the company in 1937.

The board also announced that C. W. Akin of Minneapolis had been elected executive vice president, R. V. Scott of St. Louis and B. L. Willmore of Boston, vice presidents. and J. T. Braxton of St. Louis, assistant secretary.

F. G. Bemis, Jr., manager of the Bemis plant in East Pepperell, Mass., has been appointed director of allied operations for the company, it was announced by C. W. Akin, the company's executive vice president.

Mr. Bemis will be succeeded as manager at East Pepperell by Wal-

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Formerly Industrial Division, Continental Gin Co.

ter I. Rodgers, who has been serving as assistant to the manager.

L. A. Linville, Bemis vice-president and director of Western operations, has announced the appointment of George E. Nelson as production manager of the firm's San Francisco bag manufacturing plant.

K. Stewart McCord, assistant to the Bemis director of paper procurement, has been appointed to the newly-created position of inventory administrator at the company's Boston offices. He will report directly to the vice-president and director of procurement and materials.

Mr. McCord will be succeeded in his former post by Richard F. Allen, laboratory supervisor in the Bemis paper control laboratory, Boston. H. E. Earthal, a Bemis engineer at the company's engineering research laboratory in St. Louis, will transfer to the Boston paper control laboratory as supervisor.

US Borax

Woodrow W. Lair, former assistant superintendent of the United States Borax & Chemical Corporation potash refinery in Carlsbad, N. M., has been named refinery superintendent, it is announced by Earl H. Miller, resident manager.

Lair

Joe V. Kern, who has been named assistant to Mr. Miller, joined the company in 1951.

Farmers Fertilizer

Doug Dye Jr. was elected vice-president, sales, and Arthur Shonkwiler purchasing agent for safety director, plant equipment and supplies at the annual meeting of Farmers Fertilizer Co., Columbus, O. Messrs Redman, Thomas, Cooper and Armistead were re-elected.

Marquiss Farm Supply

Virgil T. Harbach has been named plant manager for the Clinton, Ill., liquid fertilizer plant owned by Charles Marquiss. Mr. Harbach has been a salesman for Allied Chemical.

Soil Testing

Clyde N. Baker, Jr. has become vice-president, and David E. York is now treasurer of Soil Testing Services, Inc.

Lilly

At a recent meeting the board of directors of the Chas. H. Lilly Co. announced the promotion of Fenn Emerson to vice-president. Since 1950, Mr. Emerson has managed anhydrous ammonia fertilizer distribution, Eastern car lot seed sales, and export seed sales. He joined Lilly in 1942.

Emerson

White

Tellvik

Ernest E. White, present general manager, has also been named vice-president. Mr. White has been with the Chas. H. Lilly Co. since 1928.

Mal Tellvik is another new vice president. From 1952 until the time of the company's merger with the Chas. H. Lilly Co. in 1955, Mr. Tellvik managed the Portland Seed Western Washington operations.

The Portland Seed Co. is a corporate affiliate of the Chas. H. Lilly Co. and the Inland Seed Co.

Armour

Bobby G. Spikes of Monette has been added to the fertilizer sales staff of the Armour Agricultural Chemical Company. He will be the Armour fertilizer representative in Eastern Arkansas, and has already assumed this position.

Before accepting his present position, Mr. Spikes was an associate with the U.S. Department of Agriculture poultry inspection branch.

New York AES

Dr. Arthur J. Heinicke has retired as director of the New York AES at Geneva, at the age of 67. He was tendered a tribute at the State Horticultural Society meeting recently. He will retire as of June 20.

Collier C&CC

T. C. Henderson has become vice-president, manufacturing, for Collier Carbon & Chemical Corp. Elected to the board of directors are A. C. Stewart and Wm. C. Kaesche.

(Concluded on page 70)

You're really hitting the jackpot when you get better multiwalls for less money . . .

Bemis EXTENSIBLE Multiwalls

They are better than conventional multiwalls because they are shock-resistant. Two years of use prove that breakage is greatly minimized. And they frequently cost less because the greater strength lets you use a lighter basis weight bag. Read these convincing quotes from men who have had ample experience with Bemis Extensible Multiwalls . . .

"We are saving $7.10 per thousand with Bemis Extensibles, a 5½% reduction in our bag costs."

"Our savings in cost have been about $7.00 per thousand. We have had much less breakage than we previously had. In addition, our employees at the plant say that extensible bags are much easier handled at the scales and much easier to sew."

"These extensible bags are the best paper bags we have ever used. As far as I am concerned, we won't use anything else."

"We haven't had a serious complaint since we switched to your 'stretch' bag."

"We broke only two bags in two weeks. We don't want anything else."

Bemis pioneered extensible multiwalls. We have had longer experience with them than any other bag maker. You can profit by that experience. Get in touch with your Bemis Man.

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Calspray

Howard J. Grady was named president of California Spray-Chemical Corporation today following the retirement on February 1 of A. W. Mohr, president for the past 13 years. Mr. Grady also becomes president of Ortho Agricultural Chemicals Limited of Canada.

Grady

Mr. Grady, who was executive vice president at the time of his new appointment, joined Calspray in 1926. He came to the head office in Richmond, California, in 1958 as executive vice president.

Arthur W. Mohr began his career in 1922 as a chemist and sales engineer with Standard Oil Company of California. In 1947, he received an appointment to the Calspray board of directors followed shortly by his election as president of the corporation.

Mr. Mohr also leaves the post of vice president of California Chemical Company, Standard Oil Company's principal chemicals subsidiary and the parent management organization for Calspray and Oronite Chemical Company. Mr. Mohr served as a director of Oronite.

Farmers Cotton Oil

Farmers Cotton Oil Co., Wilson, N. C., has named Philip L. Beaman farm service representative. He will work closely with farmers on soil and fertilizer problems. He is a native of Walstonburg, N. C., a graduate of North Carolina State College. Prior to joining Farmers Cotton Oil Company he taught agriculture in Warrenton, N. C. He will headquarter in Wilson.

Beaman

CompuDyne

The election of John C. Williams, Jr., to the position of vice president of Weighing & Control Components, Inc., a division of the CompuDyne Corporation, has been announced by Charles D. Close, president of the parent company. Mr. Williams also was elected to the CompuDyne board of directors. Mr Williams started with the CompuDyne Corporation as a project engineer when the company was formed in 1952.

Chase Bag

John A. Brewster, vice president and director of West Coast operations for the Chase Bag Company, announces that James W. Wells, Jr., has assumed managership of its Portland, Oregon branch. Mr. Wells joined Chase when its Portland plant began operations in 1939. He traveled the Oregon territory until 1948 when he was appointed sales manager.

Wells

Stepan Chemical

Alfred C. Stepan, Jr., president of Stepan Chemical Company, Chicago, has announced the following executive promotions for the company. Dr. David B. Hatcher, formerly vice president and general manager, becomes executive vice-president and will co-ordinate operations of all divisions and subsidiaries of the company.

Wilfred J. Crepeau, formerly assistant general manager, becomes assistant to the executive vice-president. Mr. Stepan said that the promotions were a part of a corporate realignment of executive responsibilities in connection with Stepan's recent acquisition of Maywood Chemical Company and Ris-Van, Inc., which are being operated as divisions.

St. Regis

St. Regis Paper Company announces the appointment of John Todd as sales service manager in the Los Angeles, California, district of its Bag Division. Mr. Todd succeeds G. E. Dickinson, who has been transferred to the St. Regis Kraft Division at Tacoma, Washington.

Warren M. Gannon, sales manager of the Western Area of the Bag Division, has moved from the company's sales office in Los Angeles, to 235 Montgomery Street, Room 1450, San Francisco 4, California.

Richardson Scale

The appointment of Richard Gruber as its New England district manager, has been announced by Richardson Scale Co.

Address of the New England District office is P. O. Box 355 (14 Bunker Hill Parkway), West Boylston, Mass. (Telephone: Temple 5-4084).

Lummus

William M. Creasy, Lummus Major General, U. S. Army retired, a vice president of The Lummus Company, 385 Madison Avenue, New York, has been appointed manager of the company's New York division. At the same time, Dr. S. Z. Avedikian is joining Lummus as acting director of the Engineering Development center in Newark, New Jersey where he succeeds General Creasy. The announcement was made by J. F. Thornton, president of the firm of engineers and constructors..

Obituaries

Dr. Roger W. Bledsoe, 52, associate director of the University of Florida AES died suddenly in his home in Gainesville January 24 of a heart attack.

George E. Campbell, 64, manager of the purchasing department of The American Agricultural Chemical Company, died suddenly February 21 at his home in Flushing, New York. He joined AAC in 1910.

Joseph A. Howell, 58, of Richmond, Va., first president of National Plant Food Institute, died unexpectedly February 16 while on a business trip in Washington, D. C. He had recently been a consultant in the agricultural chemicals field, and was a former president of Virginia-Carolina Chemical Corporation. Mr. Howell was associated with V-C from 1922 until 1956.

Burr N. Johnson, 81, retired territory manager for F. S. Royster Guano Co., died Feb. 19 at Syracuse, N. Y., following a heart attack. He was with Royster for 25 years until his retirement 20 years ago.

Thomas S. Reynolds, 81, co-founder of Bandini Fertilizer Co., Los Angeles, of which he was secretary treasurer, died February 6 while returning from a vacation cruise to Hawaii.

Kenneth A. Spencer, 58, board chairman and founder of Spencer Chemical Company, died February 19 at a hospital in Miami Beach, Florida, from complications following a heart attack he suffered February 2, while concluding a vacation cruise in the Bahamas.

ARMOUR'S PROGRAM OF PROGRESS

...to serve you better.....

● Armour's modern ammonia plant near Crystal City, Missouri

For over sixty years, Armour has been serving American Agriculture; supplying the ever-growing demand for Armour and Vertagreen brand complete fertilizers by farmers and home gardeners. For more than a decade, we have served the fertilizer industry with phosphate products from our modern phosphate facilities in Bartow, Florida.

Each year, it has been our aim to improve our facilities, products and services. In 1959, Armour took another step forward to serve you better with the acquisition of a modern ammonia plant at Crystal City, Missouri. Now, Armour's service to agriculture and the industry is more complete than ever.

As America's needs for more and better fertilizers continue to grow, Armour Agricultural Chemical Company will continue to improve the products and services that have made the Armour "A" a symbol of quality in the fertilizer industry . . . the "BIG A" in agriculture.

31 sales offices serving the fertilizer industry

ARMOUR AGRICULTURAL CHEMICAL COMPANY
General Offices, Atlanta, Georgia

More than 300 attend

Southern Conference on Liquid Fertilizers

Some 300 representatives of the fertilizer industry, its suppliers and college and extension personnel from 13 southern states gathered at Rock Eagle Park near Eatonton, Ga. February 9-11 to consider the potential for liquid fertilizers throughout the South. A lively conference, sponsored jointly by the land grant colleges of the 13 states and Tennessee Valley Authority, gave nearly everyone what they came for.

Those who came with a preconceived opposition or scepticism found justification for their feelings, and those who came in anxious anticipation found thoughts to feed their hopes.

A well-balanced and thoroughgoing program, chairmanned by Jim Bergeaux, Georgia extension agronomist-fertilizer, considered all aspects of the liquid products and carefully compared them with their solid counterparts from physical, economic and agronomic standpoints.

After a welcome from C. C. Murray, dean of Georgia's College of Agriculture, the initial day's program got under way with a discussion of Soil Fertility Problems of the South by Walter Sowell, Alabama extension agronomist, who presented a paper for E. T. York, extension director for the state. He said that the South can compete agriculturally with any section of the nation, but it must bring down unit cost of production to remain in successful competition.

Inherently low fertility of the soils is the principal barrier, but this can be overcome with an adequate fertilizer and lime program. The hitch lies in the fact that farmers of this region have been using fertilizers so long that they feel they know all about them, he explained, but their real lack of adequate information and their feeling that they 'know it all' team up to make it hard to reach them with a message. If the fertility program gets dropped 'into the barrel' with all the other assorted extension activities, it is soon lost, he said, expressing the feeling that often extension work is set up to try to do too much for too many, spreading itself too thinly and not being able to do justice to any one program. Soil fertility educational programs must have top priority, Mr. Sowell concluded.

A. V. Slack, chemical research supervisor of the applied research branch of Tennessee Valley Authority's division of chemical development, summarized the status of liquid fertilizers. Since the first liquid fertilizer plant in the central and eastern U.S. appeared in the Midwest in 1954, some 256 plants have been built in these sections, he said. Including the far West, there are now about 354 plants producing liquid mixes.

He estimated current annual sales of liquid mixes at more than 800,000 tons, representing about 200,000 tons of plant food, or 4.5% of that applied as mixed fertilizers.

Mr. Slack reviewed supply problems, especially phosphoric acid, and summarized research and development in use of wet-process acid in liquid mixes. He discussed materials used in formulations, and trends toward new materials and suspension fertilizers.

John T. Cope, Jr., Auburn University extension agronomist compared agronomic value of liquid and solid fertilizers. He stressed no significant difference between primary nutrient values of the two, but pointed out that the nitrogen and phosphorus sources presently used in liquid fertilizers are generally acid-forming, and their continued use without liming will decrease the calcium and magnesium supplies in the soil. He also pointed out the danger of sulfur deficiency if liquid fertilizers are continually applied on many soils in the South that are now being fed with mixtures containing superphosphate, and questioned the adaptability of liquids to row placement with the accuracy that solids offer.

Gordon Futral, head of the agricultural engineering department at the Georgia Experiment Station near Griffin, reviewed the various devices which have been used in liquid fertilizer application, and compared the efficiency of some of the ones currently employed. All in all, he surmised, the equipment manufacturers have cooperated with liquid fertilizer producers so well that this application equipment is as well advanced as any new program he knows of.

Roger Woodworth and Wes Smith, agricultural economists at the University of Georgia, discussed the economics of liquid mixed fertilizer. They felt the convenience of liquid fertilizers, as with all bulk spread goods, is attractive to the farmer for several reasons. Among these are the following: per-acre application rates are increasing constantly; labor and land costs are increasing and farmers are more willing to substitute capital for land and labor; application costs are small relative to total fertilization costs. When annual use is high enough, they stated, liquid application equipment — generally more expensive than dry applicators—per-acre costs are not large.

Ernie Harper of Aylco Fertilizer, Sullivan, Ill., long-experienced in liquid fertilizers, talked about sources of supply and availability of materials required for liquid fertilizer manufacture. He covered each major element separately, and explained that the producers have the ability to supply the overall demand, and each wants more business and will prepare to serve any new or expanding market. Cleaned-up wet-process phosphoric acid could well prove to be the key to the future of liquid fertilizers in the South, he said.

A. V. Slack made his second appearance on the program, this time to discuss addition of secondary and

trace elements and pesticides to liquid fertilizers.

He told how the problem of dispersing small amounts of these materials in liquids may be simpler, and segregation difficulties are avoided, but explained that difficulties are encountered in incorporating materials that are not soluble. These, however, can usually be added as suspensions, he explained, or the element can be complexed by some agent, making it resistant to precipitation by the phosphate in the solution. Inorganic sequestering agents are promising due to their relatively lower cost, he said. Emulsifying agents developed during the past few years have simplified the addition of pesticides to liquid fertilizers, he stated, and this is generally done in the field or at truck loading, either of which offers wide flexibility.

W. W. Arnold, technical representative for Allied Chemical's Nitrogen Division, acquainted the audience with corrosion problems involved in liquid fertilizers. He described the materials used to handle liquids, and explained the different types of corrosive action encountered with the acids and salts used in formulating liquid fertilizers. He methodically covered the limitations of each kind of material used in storage, handling, and application, and told which were suitable for use under certain conditions and why.

Harold Walkup of TVA's economics branch in the division of agricultural relations presented a study on comparative costs of producing liquid and solid fertilizers in the South. He described the typical equipment provided for each hypothetical plant, and preceeded to develop materials and labor costs for side-by-side plant sites at four specific locations in the southern states. At each location he selected three grades, and analyzed overall formulation and manufacturing costs, indicating the difference in cost per ton and cost per unit of plant nutrient for the identical or similar liquid and solid grades.

Establishment and operation of liquid fertilizer plants was the topic of Hixon Guest of Macon County Truck and Tractor Co., which installed a liquid mixing plant last year at Oglethorpe, Ga.

Morris Woosley of West Kentucky Liquid Fertilizer Co., Hopkinsville, a man who has aggressively sought and used new methods in the liquid fertilizer industry, spoke on the equipment needed for producing, storing and applying liquid fertilizers.

. . . "In the beginning the formulation of liquid fertilizer was a slow and crude process," he said. "Equipment consisted of a mixing tank with an arrangement to meter or weigh in the raw materials being used. In most cases water, phosphoric acid (furnace grade) and aqua ammonia were added to the mixing tank in the order named, then potash, urea or nitrogen solution to complete the formula being produced. There is a great deal of heat generated by the chemical reaction of ammonia and phosphoric acid, the faster ammoniation is effected, the higher the temperature,

1. Some active participants in the program: W. A. Sutton, Georgia Extension Service, Athens; Fielding Reed, American Potash Institute, Atlanta; George Scarseth, American Farm Research Assn., W. Lafayette, Ind.; A. V. Slack, Tennessee Valley Authority, Wilson Dam; Morris Woosley, West Kentucky Liquid Fertilizer Co., Hopkinsville; and C. C. Murray, Georgia College of Agriculture.

2. Eric Winters, Tennessee Experiment Stations, Knoxville; L. W. Eberhart, Jr., Georgia Extension Service, Athens; Fielding Reed, American Potash Institute, Atlanta; and Leland Allbaugh, Tennessee Valley Authority, Knoxville.

3. Tom Rogers, Nitrogen Division of Allied Chemical Corp., New York; James S. Wood, Superior Fertilizer & Chemical Co., Tampa; Buck Appleton, Potash Co. of America, Atlanta; E. Y. Floyd, Plant Food Institute of N. C. and Va., Raleigh; and Sam Tisdale, National Plant Food Institute, Atlanta.

4. Panel on production, distribution and sale of liquid fertilizers: Morris Woosley, West Kentucky Liquid Fertilizer Co., Hopkinsville; A. V. Slack, Tennessee Valley Authority, Wilson Dam; Harold Walkup, Tennessee Valley Authority, Knoxville; Ernie Harper, Aylco Fertilizer Division, Unexcelled Chemical Corp., Sullivan, Ill.; and W. W. Arnold, Nitrogen Division of Allied Chemical Corp., Indianapolis.

5. Andre Claudot, French Potash & Import Corp., Paris, and Ir. Y. Araten, Israel Mining Industries, Haifa.

6. Ted Love and W. H. Mitchell, Tennessee Farmers Coop., LaVergne, and Joe Harrell, Southwest Potash Co., Atlanta.

7. B. E. Adams, Nitrogen Division, Allied Chemical Corp., Hopewell; W. E. Perry, Robertson Guano Co., Norfolk; John Dail, General Metals, Greensboro; and Grayson Morris, Cooperative Fertilizer Service, Richmond.

8. Gaines Boynton, International Minerals & Chemical Corp., Atlanta, and Grady Goodpasture, Goodpasture Grain & Milling Co., Brownfield, Texas.

thus in order that heat be kept under control, formulation under this process was slow. Production of from 5 to 10 tons of finished fertilizer per hour was about the limit.

"Increased demand for liquid fertilizer soon made this process obsolete," Mr. Woosley continued. "Production must always keep pace with demand, so the reaction chamber and the cooler were introduced as a means of increasing production per hour. These two improvements made it possible for the liquid manufacturer as a recognized part of the fertilizer industry.

"In the spring of 1958 a new problem came into the picture," he said. "Increased demand for liquid fertilizer plus a rapid increase in the number of plants resulted in a serious shortage of furnace grade phosphoric acid. TVA had announced the development of a new type of liquid phosphoric acid and we had used this new material in June of 1957 to test its advantage to the liquid producer. Since our test production had proven satisfactory we turned to superphosphoric acid as the logical answer to the acid situation, then, too, we had discovered that super acid enabled us to produce higher analysis fertilizer grades in liquid form.

"Success with one new material encourages experimentation with others. Wet process phosphoric acid being the most economical of the liquid phosphates promised tremendous saving to the liquid fertilizer industry. Experimental formulation proved that wet process acid could be used in combination with superphosphoric acid to produce all grades of liquid fertilizer. It was discovered by TVA that the super acid acted as a sequestering agent to keep the impurities contained in the wet acid in suspension. This was another step in the right direction and enabled the properly equipped plant to reduce materials cost and to use a variety of materials during periods of shortages. At the same time the new materials brought problems of their own. Superphosphoric acid is very sensitive to over ammoniation, at the same time wet process acid reacts favorably to controlled high pH during the ammoniation process and both of these materials require close control over re-action temperature.

"The need for efficient ammoniation control, plus the need for increased production per hour have been factors in our developing an improved Sparger-reactor Tube. This tube handles all three types of phosphoric acid, either as individual materials or the combination of super acid and wet process acid. This system enables us to produce up to 40 tons of finished fertilizer per hour when using continuous formulation for storage. It has helped us to reduce materials expense and to cut manufacturing cost. We save 15 cents per unit of P_2O_5 by using wet acid instead of furnace acid. Our average fertilizer grade contains 15 units of phosphate so this change has been very important to profits. We are now able to serve more customers as a result of increased efficiency. This tube has proven to be such a valuable addition to our operation that I am thinking of the contribution that it might make to the entire liquid fertilizer industry and am considering the possibility of making it available to other liquid manufacturers.

"Scope of efficient operation has been a limiting factor to the liquid manufacturer. A full scale liquid plant requires a sizable investment, it requires trained personnel for efficient operation. Interest on capital investment, depreciation and expense of operation all come out of profits, therefore a liquid plant must produce and sell a fairly large vol-

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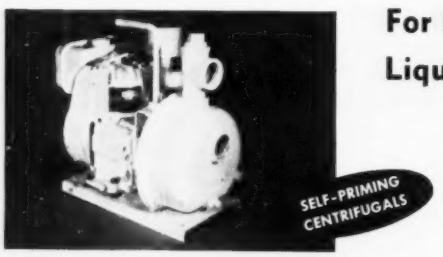

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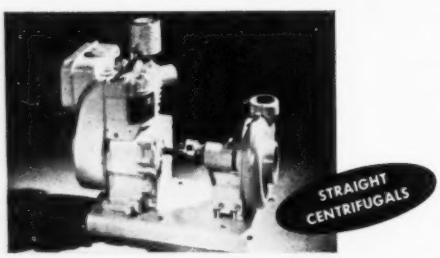

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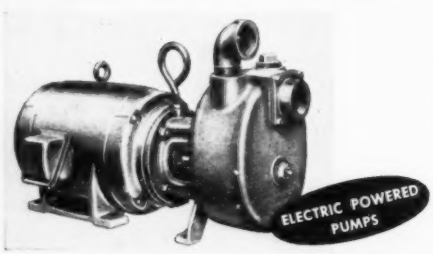

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ume to produce profits. As volume goes up, ton cost goes down and profit increases.

"The original conception of the liquid fertilizer industry was small independent plants to serve areas within a radius of 15 to 20 miles from plant location. This would seem logical since a large part of all liquid fertilizer is being applied by customer spreader trucks. Distance traveled reduces the capacity of the custom operator to serve a large number of customers. Remote storage has not proven practical because of the many grades necessary to meet varying crop needs. This problem prompted us to develop a cold mix blending plant. With this system the central plant produces certain base mix formulas that are transported by tanker truck or rail to the blending plant. There they are put in storage and blended to produce a variety of complete fertilizer grades. This blending plant is inexpensive. In most areas it would consist of three storage tanks, a metering system, a simple mixing unit and a pumping set up. In tobacco growing areas a fourth storage tank is necessary, thus with a minimum of expense the blending installation has all of the flexibility of grade production as the full-scale plant. This development has opened the door to greatly expanding the area served by the central plant. Today, plant production capacity, material supply and operating capital are the limiting factors of the liquid producer rather than area limitations. In our operation we are thinking in terms of a 125 mile radius instead of the 15 to 20 mile radius usually considered. This blending installation puts the liquid manufacturer on an equal basis with a larger solid fertilizer plant. I am confident that within the next 10 years that there will be a liquid fertilizer installation, either cold mix or manufacturing unit, in every section of agricultural importance."

Ralph Sasser, assistant county agent at Keenansville, N. C. and a former liquid fertilizer man himself, discussed the relative merits of farmer-applied vs. custom-applied liquids. He pointed out that each of these has advantages to both the farmer and the liquid fertilizer manufacturer, and also has disadvantages to each. He enumerated the advantages and disadvantages to each for both custom-applied and farmer-applied fertilizers, and detailed the cost of various types of applicator

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All six minor elements are combined in FTE. Plants get boron, iron, manganese, zinc, copper and molybdenum—exactly as needed. And as little as 1% to 1½% of FTE in the mix has proven effective in commercial fertilizers.

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rigs, citing the long-term cost of each .

At the banquet that evening, George Scarseth, research director for American Farm Research Assn., entertained as well as informed the capacity audience at the dining hall.

The program the following morning was given over to group meetings and panel discussions. Initially, the audience was split into three voluntary interest groups for separate meetings with panels of specialists. One group considered the uses of liquid fertilizer on farms while a second discussed research under way and needed, and the third group studied production, distribution and sale of liquid fertilizers. Following the group sessions, each group reported the highlights of its discussion to the entire assembly.

A panel discussion followed, outlining problems in connection with the use of liquid fertilizers. Made up of specialists from the college and extension staffs of several southern states, the group tackled the subject from agronomic, economic, mechanical and educational viewpoints at state and county levels.

To wind up the morning session J. Fielding Reed, southern manager for American Potash Institute summarized the possibilities for liquid fertilizers in the South. He wrapped up the entire meeting in a package, excerpting from the remarks of each speaker, relating the topics to one another, and clarifying the issues. In conclusion, he presented a 13-factor comparison for liquid and solid fertilizers, citing the strong and the weak points of each for the area.

The final afternoon was devoted to inspection of the sizable display of equipment used with liquid fertilizers, on exhibit in the buildings and a field opposite the auditorium.

AWARDS

$100,000

The O. J. Noer Research Foundation, a $100,000 scholarship fund, named after famed turf expert O. J. Noer, granted its first scholarship to a graduate student from India, K. M. Shah working toward his PhD at Wisconsin, a $2500 grant. Dr. Noer has resigned from his post with the Milwaukee Sewerage Commission to administer the fund, which was announced at the recent International Turf Grass Conference.

HONORS

Fred J. Woods

Fred J. Woods, president Gulf Fertilizer Co., Tampa, Fla., was presented the Honorary Degree of State Farmer, the highest award of the Florida Future Farmers of America, for his outstanding contributions to agriculture through the FFA.

Spencer Award

The Spencer Chemical Efficient Corn Growing Award for Mississippi for 1959 went to Truman Stokes of Rolling Fork.

Wiley Award

Nominations are now being accepted for the fourth Harvey W. Wiley Award presented by the Association of Official Agricultural Chemists, for achievement in analytical methods. Among previous winners, known to our industry is K. D. Jacob, USDA, who won two years ago. Last year the award went to Francis Gunther, University of California, for his work in pesticide residue analysis.

Nominations must be in by April 1, sent to the association's secretary, William Horwitz, Box 540 Benjamin Franklin Station, Washington 4, D.C.

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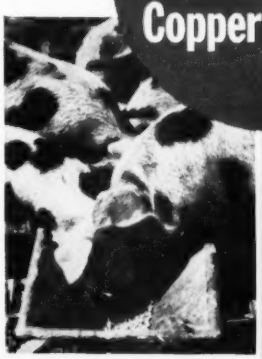

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CF Staff-Tabulated TONNAGE REPORTS

FERTILIZER TONNAGE REPORT (in equivalent short tons) Compiled by Cooperating State Control Officials and Tabulated by COMMERCIAL FERTILIZER Staff

	January		December		Oct.-Dec. Qtr.		July-December		January-June		YEAR (July-June)	
STATE	1960	1959	1959	1958	1959	1958	1959	1958	1959	1958	1958-59	1957-58
Alabama	20,335	22,378	18,434	19,521	89,701	108,599	180,959	199,250	846,309	734,077	1,045,574	906,798
Arkansas	9,422	8,769	5,376	5,434	16,911	21,667	58,714	63,767	289,365	226,889	353,132	289,641
Georgia	39,496	40,246	54,544	49,835	161,460	187,378	297,138	294,751	1,130,998	944,618	1,425,749	1,214,147
Kentucky		56,608*	23,262	17,439	59,451	60,108	108,734	99,460	491,920	435,023	583,281	523,794
Louisiana	8,576	10,101	6,670	6,511	31,468	34,219	66,744	64,152	201,642	188,409	265,794	252,601
Missouri		24,637*	34,053	44,459	124,202	198,141	272,014	362,437	563,055	420,615	926,111	755,927
N. Carolina		99,676*	42,969	33,256	115,087	138,453	175,533	228,055	1,468,704	1,261,685	1,696,759	1,461,131
Oklahoma		2,883*	1,724	2,589	26,572	25,438	72,511	68,848	64,738	55,594	133,586	107,400
S. Carolina	30,971	56,071	22,132	18,332	57,460	76,102	104,903	134,202	756,100	615,733	890,302	732,607
Tennessee	34,738	17,374	10,479	10,352	38,359	47,773	117,275	127,116	443,602	307,182	570,718	442,899
Texas	26,946	38,325	33,196	36,623	117,901	119,006	233,410	222,800	441,851	452,327	664,651	666,128
California		(reports compiled quarterly)			253,956	247,473	457,956	453,800	803,261	679,577	1,254,028	1,121,546
Mississippi		(reports compiled quarterly)				86,865*		176,371*	516,917	472,791	693,288	641,262
Virginia		(reports compiled quarterly)			72,546	84,147	141,177	160,178	618,965	549,773	779,143	690,556
Indiana				(reports compiled semi-annually)			321,956	316,341	856,316	795,506	1,172,657	1,080,465
New Hampshire				(reports compiled semi-annually)				4,746*	16,143	16,053	20,889	20,019
TOTAL	170,484	193,264	252,839	244,351	1,165,074	1,348,504	2,609,024	2,971,528	9,509,886	8,155,852	12,475,662	10,906,901

(not yet reported)

* Omitted from column total to allow comparison with same period of current year.

U.S.D.A. Clears Heptachlor For Certain Crop Applications

In a notice issued February 9, 1960, the United States Department of Agriculture cleared heptachlor insecticide for continued use on corn, cotton, fruit, berries and other important crops.

The newly approved uses result in no residues at harvest time and in compliance with the recently established zero tolerances for heptachlor and heptachlor epoxide.

The U.S.D.A. action opens the way for continued use of heptachlor in the fast growing soil insect market on corn and on cotton until bolls open. Other accepted uses include soil application for small grains, lima beans, tomatoes, and peppers. Also cleared were various berry crops, citrus, cherries, peaches, pears, and pineapple.

In addition, heptachlor can be used on tobacco, for seed treatment, and for protection of turf, recreational areas, road sides, nursery stocks and ornamentals. The latter uses afford protection against such prominent pests as fire ants, mosquitoes, grasshoppers, European chafers, grubs, and Japanese and white fringed beetles. Heptachlor can also be used for control of termites.

Applications for control of grasshoppers or other insects in pastures and range land are approved with the restriction that dairy animals cannot be grazed on treated land and animals being finished for slaughter cannot be grazed for 90 days following application.

Important uses not yet cleared include forage crops, cotton boll weevil control after bolls open, and potatoes and other root crops. Velsicol Chemical Corporation, makers of heptachlor, report that they will continue to take all steps necessary to broaden still further the approved uses of heptachlor.

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FOR SALE: 6' x 50' and 7' x 80' Rotary Dryers, 3 - Louisville 6' x 50' Rotary Steam Tube Dryers; also Mixers, Storage Tanks, Screens, Elevators. Send us your inquiries. BRILL EQUIPMENT COMPANY, 37-61 Jabez St., Newark 5, N. J.

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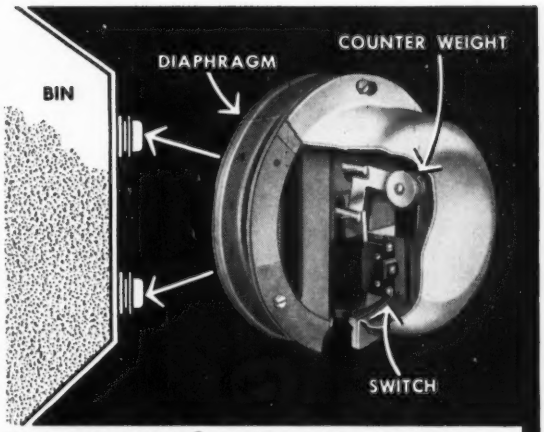

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